IMPERIAL MYCOLOGICAL INSTITUTE

REVIEW
OF
APPLIED MYCOLOGY

VOL. XXI JUNE 1942

KAWAMURA (E.). **Studies on the sex of Hymenomycetous fungi.**—*Bull. sci. Fak. Terk. Kjusu Univ.*, ix, 3, pp. 337–382, 10 figs., 3 diags., 1941. [Japanese, with English summary.]

The basidiospores of *Pleurotus ostreatus* and *Polystictus sanguineus* [*R.A.M.*, xviii, pp. 4, 221] were found to be uninucleate, their monosporous mycelia being devoid of clamp-connexions and branching at a wide angle. The pairing of compatible monosporous mycelia results in a diploid mycelium furnished with binucleate clamp-connexions and branching at a narrow angle. Fruit bodies were produced exclusively from the secondary bisporous mycelia, indicating that the species under observation are heterothallic. Mating experiments [the results of which are discussed in detail] showed both fungi to be tetrapolar.

P. sanguineus forms oidia on either primary or secondary mycelia, those produced on the former being uninucleate and giving rise to uninucleate mycelia, whereas those developing on the latter are binucleate and produce binucleate mycelia. Some monosporous mycelia cultured from a wild fruit body of *P. sanguineus* were of a light buff colour in contrast to the normal pink.

BUCHANAN (W. D.) & MAY (C.). **Technique for artificially feeding Scolytus multistriatus and Saperda tridentata spores of Ceratostomella ulmi and other substances.**—*Phytopathology*, xxxii, 1, pp. 95–97, 1 fig., 1942.

Particulars are given of a method of artificially feeding the bark beetles *Scolytus multistriatus*, *S. sulcatus*, and *Saperda tridentata* with coremia and spore suspensions of *Ceratostomella ulmi*, with and without the admixture of finely ground elm bark, under conditions precluding the external transfer of the fungus from the mouth parts to the posterior portion of the body [*R.A.M.*, xx, p. 608].

DAVIS (S. H.) & HARRY (J. B.). **A Xylaria pathogenic to Ginkgo biloba L. seeds.**—*Phytopathology*, xxxii, 1, pp. 91–93, 2 figs., 1942.

A species of *Xylaria*, tentatively identified as *X. longeana* Rhem, was isolated in the summer of 1938 from dying and dead branches of a staminate specimen of *Ginkgo biloba* at the Morris Arboretum, Philadelphia. In April, 1939 and 1940, seeds collected in the preceding autumn and stored over winter at 40° F. were planted in pots in clay loam soil with which was incorporated inoculum of the fungus from cultures on steam-sterilized wheat. In the first series of tests, the percentage of germination was reduced by the pathogen from 32 to 2 and in the second from 55·4 to 2·5, such seedlings as did emerge being severely stunted while the non-germinating seeds and non-emergent seedlings were covered with thick, black mycelial masses resembling stromata. Removal of these from the stony layer of the seed revealed black lines extending through the stony stratum into the papery layer of the testa. The causal organism was reisolated from the diseased material.

PLAKIDAS (A. G.). **Venturia acerina, the perfect stage of Cladosporium humile.**—*Mycologia*, xxxiv, 1, pp. 27–37, 3 figs., 1942.

An investigation of the leaf spot disease of red maple (*Acer rubrum*) observed near Ithaca, New York State, and also near Millinocket, Maine, in 1940, proved it to be identical with that observed by J. J. Davis in 1919 in Wisconsin and attributed to *Cladosporium humile* [*Trans. Wis. Acad. Sci.*, xix, p. 702, 1919]. The spots produced by this disease are numerous, varying in size from 0·5 to 20 mm. When young, the spots are small, black, round to angular, with a pale green halo; when older, angular to suborbicular, with irregular margins surrounded by a pale green halo, and zonate. The spots sometimes coalesce, forming very large irregular necrotic areas. The upper surface of the spots is dark reddish-brown, the lower lead-grey, both being covered by a light brown, septate mycelium from which arise short, brown conidiophores bearing oblong to fusoid-cylindrical, catenulate, unicellular to uniseptate, olive-brown conidia. Most conidiophores arise singly as lateral branches of the surface mycelium, but some arise in fascicles from a more or less tuberculate stroma.

Perithecia of an ascigerous form of the fungus, for which the name *Venturia acerina* is proposed, were found on overwintered maple leaves. Cultures obtained from single asci or ascospores all yielded conidia identical with those of *C. humile* cultured from diseased leaf tissue or from single conidia. The perithecia were scattered or gregarious, mostly erumpent, occasionally superficial, membranous, dark, globose to beaked, typically beset with stiff, dark brown, non-septate bristles in the region of the apex and with hyaline to light brown, septate hairs below, 72 to 165 by 82 to 191 (average 106·3 by 132·0) μ, the asci sessile, obclavate at first with the spores imperfectly biseriate, becoming longer and cylindrical at maturity with the spores obliquely monostichous, 62·7 to 72·6 by 8·3 to 10 (66·7 by 9·7) μ, with paraphysoids, but no paraphyses; and the ascospores oblong-elliptical, 12·5 to 14·8 by 4·3 to 5 (13·8 by 4·8) μ. An expanded description is also given of the conidial stage, *C. humile*.

With one exception, the results of all artificial inoculations were either entirely negative or slight infection only resulted. It is believed that the age of the leaf may influence its susceptibility. The fungus was found to overwinter on the leaf either in the mycelial stage, producing conidia in the spring, or in the perfect stage as perithecia.

PIRONE (P. P.) & BENDER (T. R.). **Bleeding necrosis of Sweet Gum.**—*Plant Dis. Reptr*, xxv, 18, p. 458, 1941. [Mimeographed.]

Sweet gums (*Liquidambar styraciflua*) growing at Roselle and Moorestown, New Jersey, and at Brighton and Great Kills, Staten Island, New York, show profuse bark-bleeding, usually at or a few feet above ground-level, but sometimes at a height of 20 ft. from the ground. Usually, only one or two areas on any trunk show the condition, but occasionally there may be twelve distinctly separate areas presenting the symptom. The inner bark under the ooze is dark reddish-brown, with an occasional pocket containing a white, crystalline-like solid. In advanced stages three or four rings of the sapwood are also discoloured. Upper portions of an affected tree may slowly succumb through the season, or the whole top may quickly perish. A fungus tentatively identified as *Dothiorella berengeriana* or as a closely related species was consistently isolated. Inoculation tests resulted in characteristic discoloration, but have not, so far, given rise to bleeding.

HOLZER (W. F.). **Effects of heartwood decay in Western Hemlock on sulphite pulps.**—*Paper Tr. J.*, cxii, 19, pp. 38–40, 1 fig., 1941.

Three samples of western hemlock (*Tsuga heterophylla*) heartwood from Washington virgin forests, representing three conditions, viz., sound, medium decay, and advanced decay, were cooked by a normal, calcium-base sulphite cook for a total period of nine hours, during the first 4½ of which the temperature rose to 275° F. and was subsequently

maintained thereat. The density of the wood was found to decrease with decay, but the yield per lb. of dry substance remained constant. The chlorine demand of the pulp for bleaching increased with decay, in an advanced stage of which its colour resembled that of unbleached kraft. Physical and chemical analyses of the pulps revealed definite evidence of degradation consequent on decay, but the deterioration of the fibre from this cause was less than might have been expected. Since the reaction, as judged by decrease in base in the cooking liquor, apparently proceeded at a uniform rate irrespective of decay, the reduction in the rate of pulping, gauged by bleachability and lignin content, is presumably due to a decreased solubility of lignin. Attention is drawn to the similarity of the effects on wood of decay and acid degradation.

Boyce (J. S.). **Exotic trees and disease.**—*J. For.*, xxxix, 11, pp. 907–913, 1941.

The writer has assembled much valuable and interesting information, already noticed in part in this *Review*, on the reaction to disease of exotic trees, citing some striking examples of their destruction by the fungal and insect parasites indigenous to the new habitat or coming from the native home and developing with increased virulence in their new surroundings. The same considerations apply in a somewhat lesser degree to attempts at the extension of a native species beyond its normal range. In Europe, where there are comparatively few valuable native timbers, especially among the conifers, some justification may be found for the introduction of foreign species, but this certainly does not hold good for North America, with its wealth of different varieties. Unless the exotics meet some definite requirement that cannot be fulfilled by trees of native origin, their importation into the already amply-stocked North American continent cannot be warranted.

Hulbary (R. L.). **A needle blight of Austrian Pine.**—*Bull. Ill. nat. Hist. Surv.*, xxi, 7, pp. 231–236, 4 figs., 1941.

Blighted Austrian pine (*Pinus nigra* var. *austriaca*) needles collected in northern Illinois in the autumn of 1938 were wintered out-of-doors and examined periodically. The immature stromata near the bases remained quiescent until the very early spring, when they began to develop into strongly erumpent, loaf-shaped structures; by mid-April pycnidial locules were becoming differentiated, and a month later conidia were in course of production. The distinctive Dothideaceous structure of the stroma relates the fungus under observation to certain genera in the scolecosporous division of the Phomaceae, e.g., *Hemidothis* Sydow and *Septocyta* Petrak, but various points of difference necessitate the erection of a new genus, *Dothistroma*, for the needle blight organism, which is named *D. pini* and designated the type species of the genus. The dull dark brown stromata measure 125 to 1,500 μ in length, 50 to 450 μ in width, and up to 600 μ in height. The hyaline, scoleciform conidia are straight or slightly curved, 1- to 5-, usually 3-septate, 16·5 to 29 by 3·5 μ, and are borne on hyaline or amber, simple conidiophores of approximately the same size as the conidia.

Davis (S. H.). **Sclerotium bataticola, a cause of damping-off in seedling conifers.**—*Science*, N.S., xcv, 2455, p. 70, 1942.

Sclerotium bataticola [*Macrophomina phaseoli*], isolated from Norway spruce (*Picea abies*) seedlings at the Allegheny Forest Experiment Station in 1935 by L. W. R. Jackson, was shown by the writer's inoculation experiments with pure cultures at the Morris Arboretum, University of Pennsylvania, to be pathogenic to germinating seeds and seedlings of its own host, Douglas fir (*Pseudotsuga taxifolia*), American larch (*Larix laricina*), and Jack, red, Scotch, and western yellow pines (*Pinus banksiana*, *P. resinosa*, *P. sylvestris*, and *P. ponderosa*, respectively). Pre- and post-emergence damping-off was observed in all the species tested and the fungus reisolated from the diseased plants at every stage of growth.

TUCKER (C. M.) & MILBRATH (J. A.). **Root rot of Chamaecyparis caused by a species of Phytophthora.**—*Mycologia*, xxxiv, 1, pp. 94–103, 14 figs., 1942.

The name *Phytophthora lateris* is proposed for the fungus causing a serious root rot of *Chamaecyparis* spp. in Oregon and Washington [*R.A.M.*, xx, p. 41]. The disease, which affects trees of all ages, first attacks the roots and thence spreads to the trunk and crown. The entire foliage undergoes complete discoloration (from blue to green and later tan in the blue cypress, and from green to tan in the green one) within a period of two to three months in cool and damp, or two to three weeks in hot and dry weather. Eventually, the leaves wither and dry up and the tree is killed. The condition could easily be mistaken for transplanting injury but for the very characteristic, clear line of demarcation between the necrotic and living tissues. Some blocks of nursery stock planted in infested soil were destroyed within six months, while in other infested plantings trees continued to die over a period of three to four years. When infection occurs in old-established hedgerows, three or four trees die each year, the spread being more rapid if there is drainage down the row.

The fungus is described as having hyphae continuous when young, becoming septate with age, usually smooth, but sometimes gnarled or tuberous. No sporangia develop on agar media, but they are fairly abundant on washed mycelial mats transferred from 7-day pea broth cultures (20° C.) to sterile distilled water and incubated 7 days at 20°; they are borne sympodially on sporangiophores resembling vegetative hyphae, mostly ovate, obovate, or obpiriform, occasionally elongate, hyaline to lemon-yellow, non-papillate, with a very thin and often indistinguishable apical refringent plug, 20 to 60 by 12 to 20 (average 36 by 15) μ. The zoospores are fully differentiated within the sporangium, biciliate, reniform in the motile, spherical in the non-motile phase, 10 to 12 μ in diameter. Chlamydospores develop abundantly in agar and liquid media; they are usually subspherical to spherical, occasionally ovate to irregular, with contents densely and often coarsely granular, lemon-yellow to light brown, with a wall usually thin, sometimes thick (6 to 7 μ), terminal or intercalary (the latter developing as lateral swellings of the hyphae, often appearing sessile at maturity), 20 to 77 (average about 40) μ in diameter, and germinate by germ-tubes. Oogonia, antheridia, or oospores were not observed. The optimum temperature for growth on maize meal agar was about 20°, growth being very restricted at 25°, and entirely inhibited at 30°. The fungus grows more slowly on potato dextrose, maize meal, and oatmeal agars than related species with non-papillate sporangia. Its pathogenicity was easily demonstrated by inoculating the bark or the soil around the roots with cultures or adding infested soil to the soil on the site of the future planting. All varieties of *C. lawsoniana* were found to be susceptible to the disease, some of *C. obtusa* were susceptible and others resistant, while all of *C. pisifera* showed resistance.

YORK (H. H.). **Tree-wound dressings.**—*Bull. Morris Arbor. Univ. Pa*, iii, 21, pp. 73–77, 1941.

Essential properties of a tree-wound dressing [*R.A.M.*, xxi, p. 53] should include non-injuriousness to the cambium and adjacent tissues; good penetrative capacity; a chemical content of strong fungicidal activity; a preventive influence in respect of drying-out and cracking of the wood; virtual insolubility in water; and resistance to extremes of temperature. Most of these requirements are fulfilled by orange shellac, an alcoholic and consequently germicidal preparation, which should be liberally applied to the inner living bark, cambium, and sapwood before treatment with a waterproof dressing, e.g., asphaltum dissolved in a volatile hydrocarbon, Bordeaux paint (Bordeaux mixture and raw linseed oil), or lead and zinc paints. Creosote and its mixtures or asphaltum dissolved in turpentine or mineral oil are apt to injure the cambial region of the wound, and are further not consistently reliable as antiseptics. Where the colour of the wound dressing is objectionable, shellac may first be applied to the cambial region, the exposed wood then sterilized with copper sulphate, the

dried surface again coated with shellac, and finally a paint put on to match the bark, finishing off with a spar varnish to prolong durability. Apart from the tediousness of this method, it has been found one of the most satisfactory of the wound dressings tested by the writer.

RABANUS (A.). **Der Schutz des Holzes gegen schädigende Einflüsse durch Pilze, Tiere und Chemikalien.** [The protection of timber against injurious influences of fungal, animal, and chemical origin.]—*Chem. Fabr.*, xiii, 21, pp. 388–394, 1940. [Abs. in *Holz Roh- u. Werkstoff*, iv, 8, p. 299, 1941.]

Following brief notes on the fungal, insect, and chemical agencies of damage to timber the various methods of protection are discussed, viz., painting, injection, vacuum pressure, sap expulsion, osmosis [*R.A.M.*, xx, p. 505], and bandaging as a supplementary treatment. The antiseptics mentioned include oils, especially coal tar oil, and the water-soluble substances, mercuric chloride, copper sulphate, zinc chloride, and fluorine compounds [ibid., xvii, p. 216; xix, p. 379], comprising fluralsil [ibid., xv, p. 546], basilite, zinc-meta-arsenite, and (of particular importance) the fluorine-chromium-dinitro and fluorine-chromium-arsenic-dinitro mixtures. During 1938 the consumption of coal tar oil and water-soluble impregnating salts in Germany amounted to some 120,000 and 2,000 tons, respectively, but the prevailing war conditions have limited the materials available for timber preservation to simple fluorine-dinitro mixtures and zinc chloride. The determination of the fungicidal efficacy of preservative substances is tested by the rapid DIN DVM 2176 process. Other subjects dealt with are the effects of alkaline and acid solutions on the treated wood, a brief reference to the relation between the breadth of the annual rings and wood quality, and the possibility of reducing the permeability of the timber by injections of appropriate substances.

ADAMS (G. A.) & LEDINGHAM (G. A.). **Biological decomposition of chemical lignin. I. Sulphite waste liquor.**—*Canad. J. Res.*, Sect. C, xx, 1, pp. 1–12, 1942.

In an attempt to find profitable methods of utilizing sulphite liquors (a waste product of sulphite pulp manufacture produced in the ratio of approximately 10 tons of waste liquor for every ton of pulp, and containing on an average 10 to 20 per cent. solids, of which 60 per cent. is the lignin section and 15 to 20 per cent. the soluble sugars), the possibility of decomposing lignosulphonates by micro-organisms was investigated. The wood-staining fungus, *Endoconidiophora adiposa*, chosen for this study, proved capable of decomposing approximately 10 per cent. of the lignin fraction of sulphite liquor media as measured by the β-naphthylamine precipitation method. It was also capable of fermenting up to 86·61 per cent. sugar, whereas yeast is able to utilize only 60 per cent. of the total sugars. For the preparation of the cultural medium from the waste liquors, it was necessary to remove toxic substances such as the free sulphur dioxide (by boiling for 15 minutes with vigorous aeration), adjust the P_H value at or slightly above 5·0 with the help of some neutralizing agent, and add nitrogen and phosphorus, in which the liquors are deficient. Of the neutralizing agents tested, the best results were obtained with a mixture of calcium and magnesium carbonates, or, in another test, with sodium carbonate. As sources of nitrogen, organic and ammonia nitrogen were more satisfactory than inorganic nitrates, while phosphorus may be used in form of various phosphates, of which ammonium phosphate has the advantage of supplying nitrogen at the same time.

LEDINGHAM (G. A.) & ADAMS (G. A.). **Biological decomposition of chemical lignin. II. Studies on the decomposition of calcium lignosulphonate by wood destroying and soil fungi.**—*Canad. J. Res.*, Sect. C, xx, 1, pp. 13–27, 1942.

In the second contribution to this series [see preceding abstract], the lignin-decomposing properties of 106 cultures of wood-destroying and soil fungi were studied on a

standard synthetic medium containing calcium lignosulphonate isolated from sulphite waste liquor. In general, it appeared that wood-destroying fungi were more variable and difficult to cultivate than soil fungi. The *Alternaria* spp. gave consistently the greatest lignin breakdown, ranging from 12 to 18 per cent. in replicate tests, while *Fusarium* spp., although capable of equally good lignin decomposition in individual tests, gave varying results in duplicate experiments at a later date. Of the other genera tested, *Trichoderma* and *Phoma* are considered promising. A slight positive correlation was found between the Bavendamm tannic acid reaction for identifying lignin decomposing fungi and the lignosulphonate breakdown after 60 days' growth.

AFANASIEV (M. M.). **Phosphate deficiency of Sugar Beets in Montana.**—*Plant Dis. Reptr*, xxv, 16, pp. 414–415, 1941. [Mimeographed.]

Phosphate deficiency, which is stated to be prevalent in sugar beet crops in the irrigated soils of Montana, is characterized by a necrotic, marginal or interveinal, brown to black foliar spotting, accompanied in severe cases by burning and shrivelling, the leaves presenting the aspect of an upward-curling crescent. The petioles may also be involved, turning black and dying, and thereby affording ingress to rot-producing organisms which may extend downwards into the roots. An important factor in the development of symptoms is believed to be an unbalanced nitrogen-phosphorus ratio. On land cropped to lucerne for several years sugar beets often develop black root [*R.A.M.*, xix, p. 637], succeeded in the surviving plants by acute phosphate deficiency, the nitrogen content of the soil being maintained during the growth of the lucerne while the available phosphates are materially reduced.

HEWITT (W. B.) & HOUSTON (B. R.). **Association of Pierce's disease of Grapevines and Alfalfa dwarf in California.**—*Plant Dis. Reptr*, xxv, 19, pp. 475–476, 1941. [Mimeographed.]

Pierce's disease of the vine [*R.A.M.*, xix, p. 693] is stated to be increasing rapidly in many Californian vineyards, and to have completely destroyed many of them in some localities. Evidence has been obtained which demonstrates that the condition is due to a virus transmissible by grafting, while its manner of spread indicates the presence of an insect vector. In some areas, rapid spread appears to be associated with proximity to lucerne fields affected with dwarf disease [ibid., xvi, pp. 753, 816], which also appears to be spread by an insect. Lucerne dwarf has been present for some years in parts of southern California where Pierce's disease has been very severe, and is now very common in the San Joaquin Valley areas, where Pierce's disease has recently become important. Both in vineyards and lucerne fields, the first plants to become affected are generally found along the edges adjoining irrigation canals, ditches, roadsides, and fences, where various grasses have been allowed to grow.

DU PLESSIS (S. J.). **Isariopsis leaf-spot in Vines.**—*Fmg S. Afr.*, xvii, 190, pp. 60–65, 6 figs., 1942.

Vine leaf spot due to *Isariopsis fuckelii* (Thuem.) du P[lessis] [comb. nov. ?] [cf. *I. clavispora*: *R.A.M.*, xvii, p. 843] first appeared in South Africa in 1939–40, in a Stein grape vineyard in the Bottelary area, Stellenbosch. Infection was also noticed at Wellington. Only the leaves are affected, but the premature leaf-shedding caused may weaken the vines. The disease appears to develop about the middle of November, and then gradually spreads, particularly after rain, until vegetative growth ceases. The spots then rapidly become more numerous, especially after harvesting. All the leaves may become heavily infected one month after picking.

New spots are indistinct, blackish-brown, and more or less circular. Later, their circular shape becomes more regular. On the upper surface of the leaf they are sharply outlined by a slightly raised, narrow, dark brown margin, while the enclosed area is light greyish-brown. On the lower surface, fully developed spots are dark brown, and

the brown edge is less distinct, while the central parts are darkly speckled. When numerous spots are present, they may coalesce, causing a gradual yellowing and subsequent browning of the leaves. Discoloration starts at the top, and leads to desiccation, the leaves then being readily torn by the wind.

The fungus forms its spores in the middle of the spots, generally on the lower surface of the leaves. These spores are borne on broom-shaped conidiophores which are highly resistant and persist on old rotting leaves left lying in infected orchards. Infection spreads from such leaves during the spring. Entry occurs mainly through the stomata, infection being favoured by hot, moist weather. Heavy dew after harvesting assists rapid spread, but at this stage rain does not appear to be essential.

The most effective control consists in the removal and distribution of all leaves in affected vineyards, or their ploughing under during early winter, and in the thorough application of Bordeaux mixture (4–4–50), verderame dust, copper-sulphur dust, or (particularly) sulphur when the shoots are about 10 in. long, after flowering, four weeks later, and immediately after picking.

Legislative and administrative measures.—*Int. Bull. Pl. Prot.*, xv, 12, pp. 226M–227M, 1941.

Colombia. Decree No. 1123 of 20th June, 1941, places under the supervision of the Ministry of National Economy the functions of the Agricultural Department of Magdalena, established by Decree No. 671 of 3rd April, 1941, including those relating to the control of Sigatoka disease of bananas (*Cercospora musae*) [*R.A.M.*, xviii, p. 144]. Under the new arrangement, the campaign against Sigatoka disease will be carried out by the National Government in plantations where the treatment would be justified in the opinion of the Government technicians. Of the cost of fungicidal treatment and other necessary measures against the disease, 55 per cent. will be borne by the Government and the remainder by the growers concerned, to whom loans for this purpose will if necessary be made under the terms of the contract drawn up between the Government and the Magdalena Fruit Company.

Rumania. A Resolution (No. 1,129 of the Council of Ministers) of 15th September 1941, requires all farmers to treat with copper sulphate or other officially recognized chemicals any wheat seed-grain intended for the crop of 1941–2 as a precaution against bunt (*Tilletia* [*caries* and *T. foetida*: ibid., xviii, p. 732]), which is hereby declared an infectious disease injurious to its host.

Faes (H.). **Station fédérale d'essais viticoles et arboricoles à Lausanne et Domaine de Pully. Rapports annuels 1939 et 1940.** [Annual reports for 1939 and 1940 of the Federal Viticultural and Arboricultural Experiment Station at Lausanne and Domaine de Pully.]—*Annu. agric. Suisse*, lv, 7, pp. 703–738, 6 figs., 1941.

The following are among the items of phytopathological interest in these reports [cf. *R.A.M.*, xix, p. 262]. The cold spring of 1939, followed by a wet summer and autumn, greatly complicated the work of downy mildew [*Plasmopara viticola*] control. Both in 1939 and 1940, copper oxychloride of the cuprenox [ibid., xx, p. 339] type proved equally effective with Bordeaux mixture of comparable copper content (2 kg. copper sulphate = 1·6 kg. cuprenox) in the elimination of the fungus, the former possessing the further advantages of easy dilution without neutralization and absence of any tendency to scorch the foliage even of nursery plants. In wet seasons the normally advisable addition of a 'wetter' to Bordeaux mixture should be omitted. Reference has already been made [loc. cit.] to the promising results of experiments carried out in 1940 with a view to economizing in the use of copper for mildew control by the reduction of the copper sulphate content to 1 per cent., neutralized by the same amount of lime. Alkaline mixtures of this type dry up the rain drops on the leaves too rapidly for the pathogen to develop while the atmosphere is still moist. In 1940 the Station was presented with a stationary spraying installation, which has given entire

satisfaction. The popularity of such installations among Swiss vintners is constantly increasing.

Cryptonol [ortho-oxyquinoline: ibid., xviii, p. 554], applied to vines naturally or artificially infected by the coître or hail disease within three hours of the establishment of the pathogen (*Coniothyrium diplodiella*) [ibid., xvii, p. 375; xix, p. 263] on the host, retarded the spread of the fungus and virtually inhibited the formation of pycnidia; unwounded grapes were seldom involved and the axis never, with the result that comparatively little damage was caused.

Experiments on the joint control of apple scab (*Venturia* [*inaequalis*]) and codling moth (*Carpocapsa* [*Cydia*] *pomonella*) were conducted over the six-year period from 1933 to 1938, and confirmed the importance, in respect of the fungal parasite, of pre- and post-blossom treatments with 2 per cent. lime-sulphur plus 0·05 per cent. copper oxychloride [ibid., xx, p. 411].

The sole effective control measure in the case of apple mildew (*Podosphaera leucotricha*) [ibid. xix, p. 263] consists in the prompt and thorough excision of the infected leaf and flower clusters and the immediate application of lime-sulphur. Among the varieties particularly susceptible to this disease are Gravenstein, Jonathan, Transparent, Bismarck, Landsberg Reinette, and Cox's Orange Pippin, while the Canadian and Baumann's Reinettes and Beauty of Boskoop are fairly resistant.

For some years the standard method of combating shot hole [of stone fruits: *Clasterosporium carpophilum*], viz., one pre- and one post-blossom application of a 0·5 per cent. copper-containing mixture or 2 per cent. lime-sulphur has been superseded by a single combined insecticidal and fungicidal treatment, immediately before the resumption of growth, of 4 per cent. soluble carbolineum plus 2 per cent. copper oxychloride [loc. cit.], the results obtained with which in 1939 and 1940 were fully equal to those of the ordinary schedule.

The following programme is recommended for the control of *Didymella applanata*, which was first observed in Switzerland in 1915 and now causes heavy depredations in raspberry plantings [ibid., xvii, p. 375]: removal and burning of dry or wilting shoots in the spring; two to three applications, between mid-May and flowering, of Bordeaux mixture or copper oxychloride plus an adhesive; post-harvest (August to September) treatments with copper dusts; and during the dormant period (November to February) spraying with 2 per cent. Bordeaux mixture.

The season of 1939 was very conducive to the infection of gooseberries by anthracnose (*Pseudopeziza ribis*), which defoliated untreated bushes by the end of August, except in the case of the resistant Red Dutch, Eastling aus Vierlanden, White Versaillaise, and Haughton Castle varieties. Good control (except on the highly susceptible Large White, Hero, and Fay's New Prolific) was obtained by the application on 31st March of 1 per cent. Bordeaux mixture or 0·5 per cent. cuprenox and on 7th and 19th May of 0·5 per cent. Bordeaux mixture or 0·2 per cent. cuprenox.

Endives are grown on a large scale in the canton of Geneva and round Yverdon, where they are subject to attack by *Sclerotinia minor* and *S. sclerotiorum*. Satisfactory control of the pathogens on a small scale was effected by soil disinfection with formalin, mercurial products, or steam (particularly the last-named), but these methods would be impracticable in commercial plantings, where attention should be directed to the application of a well-balanced manuring system with a basis of potash and phosphoric acid, excluding nitrogen and organic matter, and avoiding a sequence with lettuce, carrots, or other hosts of the fungi concerned.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, liii, 1, pp. 29–32, 3 figs., 1942.

In New South Wales, humid weather during January and February is often accompanied by epidemics of peach and nectarine brown rot (*Sclerotinia fructicola*) [*R.A.M.*, xix, p. 550; xxi, p. 123]. Provided careful attention has been given to orchard sanita-

tion, good results are to be looked for from fruit cover sprays applied a few days before picking. In the coastal, tableland, and hill districts, where dessert varieties are cultivated, copper sprays cannot be applied to peach or nectarine trees in leaf without severe foliage injury, but the following sulphur treatments have proved satisfactory: lime-sulphur (commercial liquid lime-sulphur containing approximately 20 per cent. polysulphide sulphur W/V), 1 gal. to 160 gals. water; colloidal sulphur, 1 to 2 lb. per 100 gals. water; wettable sulphurs 5 lb. per 100 gals. water; and a combination of 1 gal. lime-sulphur in 320 gals. water, plus either colloidal sulphur 1 lb. to 100 gals. or wettable sulphur 5 lb. per 100 gals. This last mixture combined good coverage and low potentiality for polysulphide injury, with a reasonably high sulphur content. An effective wetting and spreading agent should be combined with each of these sprays.

Diseases recorded for the first time in New South Wales during November, 1941 included papaw powdery mildew, due to a species of *Oidium*, an apricot bacteriosis, due to an organism as yet unidentified, the symptoms of which consisted in blossom blight, tip-wilt, leaf spot, and twig and limb cankers with gumming, and peach rusty spot [ibid., xx, p. 311], observed from time to time since 1933–4, but not before recorded.

WILLIAMS (R. O.). **Trinidad and Tobago. Administration Report of the Director of Agriculture for the year 1940.**—16 pp., 1942.

This report [cf. *R.A.M.*, xix, p. 261] contains (pp. 4, 14) the following items of phytopathological interest. The cacao industry in Trinidad has seriously deteriorated owing to witches' broom [*Marasmius perniciosus*: ibid., xx, p. 453] and inadequate cultivation. The continued spread and increased intensity of infection by *M. perniciosus* make the discovery of resistant strains a problem of the utmost importance. Resistance trials are in progress at Marper with material from the Amazon, Ecuador, and Trinidad. The most disturbing feature of the disease is the increase in pod infection during recent years. In Tobago infection is very slight and limited to certain small areas.

Grapefruit scab [*Elsinoe fawcetti*: ibid., xvii, p. 454; xx, p. 460] continues to threaten the production of clean fruit for export in the same limited area as before, but infection was not severe. The loss of numerous lime trees and the deterioration of others through root disease [cf. ibid., xv, p. 716; xvii, p. 671] is a serious problem in lime cultivation throughout the island.

The loss of Bocare immortelle trees [*Erythrina glauca*] through *Sphaerostilbe musarum* [*Calostilbe striispora*: ibid., xx, p. 453] is of importance because of the resultant exposure of the cacao and the ingress of grass weeds. The fungus was common on moribund cacao during the rains.

Banana output remains limited owing to the prevalence of leaf spot [*Cercospora musae*], the severity of which is much reduced by shade; and the provision of light shade for bananas is recommended.

WALLACE (G. B.). **Report of Plant Pathologist.**—*Rep. Coffee Res. Exp. Sta., Lyamungu, Moshi, 1939* (*Pamphl. Dep. Agric. Tanganyika* 27), pp. 17–18, 1941.

During 1939, further spraying tests against coffee leaf disease (*Hemileia*) [*vastatrix*] were conducted in Tanganyika [*R.A.M.*, xix, p. 591; xx, p. 573], using 1 per cent. Bordeaux mixture, 0·5 per cent. Bordeaux mixture, and a proprietary form of copper hydroxide. The results indicated that the first two treatments were equally satisfactory, while the third hardly gave any improvement over the control. The end of February would appear to be the best time for spraying, especially if the trees have not been sprayed before. If a second application is required, the end of November is the most suitable time. Growers wishing to apply the full quantity of Bordeaux mixture should apply half strength at the end of February and the end of November.

Plum trees in the Usambara mountains showed root infection by *Ustulina zonata*, on

the fructifications of which an unidentified species of *Nectria* was observed. Apple trees in the same locality were affected by pink disease (*Corticium salmonicolor*). Gram [*Cicer arietinum*] leaves at Lindi showed infection by *Uromyces appendiculatus* and lucerne on Kilimanjaro by *U. striatus*. Cowpeas at Lindi were attacked by mildew (*Erysiphe polygoni*), though mosaic is locally the most severe disease of this crop.

WALDEE (E. L.), KENT (G. C.), & MELHUS (I. E.). **Studies in the redistribution of some phytopathogenic species of Bacillus.**—Abs. in *Proc. Iowa Acad. Sci.*, xlvi (*1939*), pp. 179–180, 1940.

The recent exclusion from the genus *Bacillus* of non-endospore-formers [*R.A.M.*, xvi, p. 482] necessitates a revision of the position of eight species of peritrichous phytopathogenic organisms. Preliminary cultural and cross-inoculation studies on 75 isolates of the latter indicated their relegation to two separate and distinct groups, one of which may be included in *Erwinia*, while the other, comprising the agents of soft rot, will either be referred to an already existing genus or form the foundation of a new one.

WALDEE (E. L.). **The relationship of some bacterial plant pathogens to the coliform bacteria.**—Abs. in *Proc. Iowa Acad. Sci.*, xlviii (*1941*), p. 197, 1941.

Of twelve species of bacterial plant pathogens compared by means of cultural and biochemical tests with certain coliform bacteria, only one, *Bacterium dissolvens* [*R.A.M.*, xii, p. 426], was found to belong to the latter group, and should be regarded as a member of the genus *Aerobacter*. The soft rot organisms [see preceding abstract], *Bacillus carotovorus* [*Erwinia carotovora*], *B. phytophthorus* [*E. phytophthora*], *B. atrosepticus* [*E. phytophthora*], *B.* [*E.*] *aroideae*, and *B. melonis*, differed in various important respects from the coliform bacteria, but appear to be very closely related to *Serratia marcescens*. *B. amylovorus* [*E. amylovora*], *B. tracheiphilus* [*E. tracheiphila*], and *B.* [*E.*] *salicis* have already been relegated to *Erwinia* and shown to be only distantly connected with the coliform group. The exact affinities of *Bact.* [*Xanthomonas*] *stewarti* are still in doubt, but it appears to be closely allied to *Erwinia*, while *B.* [*E.*] *lathyri* and *B.* [*E.*] *ananas* approximate to *S. marcescens* rather than to the coliform bacteria.

LACEY (MARGARET S.). **Studies in bacteriosis. XXV. Studies on a bacterium associated with leafy-galls, fasciations and 'cauliflower' disease of various plants. Part IV. The inoculation of Strawberry plants with Bacterium fascians (Tilford).**—*Ann. appl. Biol.*, xxix, 1, pp. 11–15, 1 pl., 1942.

In further studies on the organism causing fasciation in sweet peas and various growth abnormalities in other plants, identified in a previous paper as *Bacterium fascians* [*R.A.M.*, xviii, p. 596], inconclusive results were obtained from inoculations of strawberry plants grown from runners in an attempt to reproduce the 'cauliflower' disease. Of all plants inoculated during a period of 18 months at all stages of growth, only 25 per cent. developed 'cauliflower' symptoms of varying degree at various times after inoculation, but most of them recovered completely after some time, only a few plants dying as a result of severe infection. The inoculation of strawberry seedlings (variety St. Jean), carried out during 1938, produced infection in 20 out of a total of 36 plants, while seven died after inoculation, probably from wounds. Of the infected plants, nine were severely diseased, three dying 5 to 10, and six 14 months after inoculation; the remaining 11 plants were only slightly affected, four of them recovering during the following summer, while seven remained small and unhealthy looking, but showed no definite 'cauliflower' symptoms. Of the 36 St. Jean seedlings inoculated during 1939, 30 developed some type of abnormal growth one to ten weeks after inoculation; of these one half developed definite gall tissue and the other half abnormalities such as the division of the primary shoot into several poor, weak secondary

crowns and the production of small, fasciated leaves. An attempt to infect St. Jean seedlings in the absence of wounds (by brushing) was successful, seven plants out of 24 developing gall tissue within a period of 5 to 12 weeks after inoculation.

Singh (B. N.). **Selection of bacterial food by soil flagellates and amoebae.** —*Ann. appl. Biol.*, xxix, 1, pp. 18–22, 1942.

The selectivity in bacterial food by one large and one small amoeba and a soil flagellate, *Cercomonas crassicauda*, was tested on cultures of 48 strains of bacteria, which included a miscellaneous group mostly from soil, a group of *Rhizobium* strains, and a group of plant pathogens, composed of *Phytomonas* [*Bacterium*] *tumefaciens*, *P.* [*Xanthomonas*] *hyacinthi*, *P.* [*Pseudomonas*] *mori*, *Phytomonas* [*X.*] *phaseoli*, *P.* [*Pseudomonas*] *syringae*, *Phytomonas* [*X.*] *malvacearum*, *Erwinia tracheiphila*, *E. carotovora*, and *E. solanisapra*. Of the latter group, all were either completely or partly eaten by *C. crassicauda*; and all but the two strains of *X. hyacinthi* and the one of *X. phaseoli* used were completely eaten by the two amoebae (with the exception of one of the three strains of *Bact. tumefaciens* used, which was eaten by the large, but not by the small amoeba). The plant pathogens that were inedible by amoebae produced an exo-toxin harmful to amoebae, but apparently without effect on the flagellate. Since it thus appears that some plant-pathogenic bacteria are eaten by protozoa, it is concluded that the incidence of bacterial diseases of plants may be influenced by the presence of protozoa in the soil.

Wiesner (B. P.). **Bactericidal effects of Aspergillus clavatus.**—*Nature, Lond.*, cxlix, 3778, pp. 356–357, 1942.

Two strains of *Aspergillus clavatus* were found capable of sterilizing liquid media infected with *Staphylococcus aureus* and other organisms. These moulds invested simple liquid media such as Czapek Dox solution with distinct antibactericidal properties. Small portions of the medium on which the mould has been grown inhibit the growth of *S. aureus* in glucose broth and other media. Larger quantities of medium are bactericidal. In intermediate dilutions an initial phase of bacteriostasis may be followed by bactericidal action. The active substance differs from penicillin [*R.A.M.*, xxi, p. 67] in being bactericidal as well as bacteriostatic, in being relatively stable, and in inhibiting and killing a number of organisms not attacked by penicillin.

Novitzki (S. I.) & Kokoina (Mme R. I.). Ржавчина злаков и меры борьбы с нею. [Rusts of Gramineae and their control.]—99 pp., 11 figs., Rostoff-on-Don, Rostoff District Publishing Office, 1941. Roubles 1·75.

This is a popular booklet on the rusts of cereal crops and their control under conditions obtaining in southern U.S.S.R.

Craigie (J. H.). **Aerial dissemination of plant pathogens.**—*Proc. sixth Pacif. Sci. Congr., 1939*, pp. 753–767, [? 1940].

In this paper the author discusses, with numerous references to the relevant literature, the question of the aerial dissemination of plant pathogens. The points dealt with include high spore production by certain fungi, altitudes reached by spores, rate of fall, distance carried, and relation of aerial spread to distribution of physiologic races of cereal rusts (*Puccinia* spp.).

Waterhouse (W. L.) & Watson (I. A.). **Australian rust studies. VI. Comparative studies of biotypes of race 34 of Puccinia graminis tritici.**—*Proc. Linn. Soc. N.S.W.*, lxvi, 5–6, pp. 269–275, 1 pl., 1941.

A tabulated account is given of the comparative cultural experiments carried out at St. Paul, Minnesota, in 1939, and at the University of Sydney in 1940 to determine the relationship between the American and Australian physiologic races of *Puccinia graminis tritici* both designated 34 [*R.A.M.*, ix, p. 703; xx, p. 522]. Judging by the

inconsistent reactions to the two races of a number of standard differential and other wheat varieties and inbred lines of rye when tested at varying temperatures and light intensities, as well as by differences in the colour of the uredosori, which are burnt sienna in the United States race and Sanford's brown (Ridgway) in the Australian, two distinct entities are represented. In the authors' opinion, these are best described by the term 'biotypes' (defined as a single individual or group of individuals having the same genetic constitutions), as proposed by Christensen and Rodenhiser [ibid., xix, p. 731], since neither 'physiologic race' nor 'isolate' bears quite the requisite connotation. In the case of *P. g. tritici* two isolates may or may not be the same biotype. Where hybridization on barberries is prevalent, a physiologic race may be expected to comprise a number of biotypes, but under Australian conditions, where infection of the alternate host is rare, race 34 probably embraces relatively few biotypes, which have mostly arisen in the asexual stage.

Corkle (Marie A.) & Melhus (I. E.). **The earliest known epiphytotic of rust in Iowa.** *Proc. Iowa Acad. Sci.*, xlviii (*1941*), pp. 147–157, 1941.

The writers have collected a number of county agricultural societies' and newspaper reports, as well as statistical data, bearing on the disastrous failure of the Iowa wheat and oats crops in 1858 due to rust (presumably stem rust [*Puccinia graminis*]).

Holton (C. S.) & Rodenhiser (H. A.). **New physiologic races of Tilletia tritici and T. levis.**—*Phytopathology*, xxxii, 2, pp. 117–129, 1 fig., 1942.

Three new physiologic races of *Tilletia tritici* [*T. caries*], T–12, T–13, and T–14, and two of *T. levis* [*T. foetida*], L 9 and L 10, are described, bringing the total number of known races of the two smuts to 24, 14 of the former and 10 of the latter species [*R.A.M.*, xxi, p. 249]. The three new races of *T. caries* originated, respectively, in Oregon, Washington, and Idaho, and the two of *T. foetida* in Idaho and Washington, T-12 and T-14 having been collected in commercial wheat fields, T–13 on Albit in a nursery, L-9 on Ridit, in a commercial field, and L–10 also on Ridit in an increase plot.

In a series of tests on differential wheat varieties from 1937 to 1940, T–12 was distinguished by the susceptible reaction of Hohenheimer, Albit, and White Odessa, and the intermediate response of Martin, T–13 by its pathogenicity to Ridit, Hassar, Albit, and White Odessa and T–14 by the susceptibility of Albit and White Odessa only. The identity of L-9 is based on its pathogenicity to Ridit and Albit, and that of L-10 on the intermediate reaction of Ridit. The average number of internodes per culm in Hybrid 128 and Albit inoculated with T–13 was 5·8 compared with the same figure and 5·7 in the bunt-free controls of the two varieties, and the length of the internodes 12·8 and 13·7 cm., respectively, as against 17·2 and 16·9 cm., respectively, in the controls. Apart from the development of T–13 from T–11, presumably through a genetic change not yet fully understood, most of the races used in tests on winter wheats at Pullman, Washington, have proved highly stable.

Leeper (G. W.). **Manganese deficiency and accumulation of nitrates in plants.**—*J. Aust. Inst. agric. Sci.*, vii, 4, pp. 161–162, 1941.

In work at Melbourne University, oats were grown in a small experimental area in which this plant develops 'grey speck' [*R.A.M.*, xxi, p. 193]. The soil is a grey sandy loam overlying yellow clay, and was heavily limed twenty years ago. Seeds are sown with a mixture equivalent to 300 lb. per acre of superphosphate and 20 lb. of manganese sulphate, but oats are still affected, though barley and wheat are not. Every oat plant showing marked symptoms of manganese deficiency was ascertained to give a strongly positive reaction for the presence of nitrate in the stalk. At the same time, Dawn oats growing in two pots of Western Australian gravelly soil successfully treated to overcome grey speck did not show a trace of nitrate, while Black Mesdag

oats on the University soil gave only a slight nitrate reaction. This strain is relatively insensitive to manganese deficiency. Canary grass (*Phalaris minor*) a common weed in this soil, displaying the same leaf markings as oats when affected by manganese deficiency, though it is less susceptible, showed no trace of nitrate when healthy, though affected plants gave an intense reaction. Wimmera rye grass [*Lolium perenne*], growing vigorously in the same soil, showed no trace of nitrate. The amount of nitrate present in the soil at the time was under one part per million of nitrogen.

WARK (D. C.). **Addition of hormones to mercurial fungicidal dusts that reduce germination of Wheat.**—*J. Aust. Inst. agric. Sci.*, vii, 4, pp. 156–158, 1941.

Evidence having been obtained that a fungicidal dust containing 1·5 per cent. of mercury as ethyl mercury phosphate appreciably reduced the germinability of wheat seed-grain stored for two to eight weeks before seeding, a trial was made in which α naphthyl acetic acid and β indolyl acetic acid were each carefully ground into samples of a dust containing 1·5 per cent. of mercury as ethyl mercury phosphate, giving a range of concentrations of from 2·5 to 40 parts per million of the dry weight of the seed when the dust was used at the rate of 2 oz. per bush. After 13 weeks' storage, a field germination test was made. The undusted seed then gave 77·3 per cent. germination, as against 47 per cent. for that dusted without hormones. The samples containing 2·5, 5, 10, 20, and 40 p.p.m. α naphthyl acetic acid gave, respectively, 56·3, 51·3, 57·8, 58·3, and 59·3 per cent. germination, the corresponding figures for the samples with β indolyl acetic acid being 64·8, 59·3, 58, 55·8, and 48 per cent.

In laboratory germination studies it was noted that the mercurial dust reduced the average length of the root system and coleoptile, and that β indolyl acetic acid, except at the lowest concentrations, still further reduced them, the reduction increasing with increasing concentrations.

A further trial was then made, in which β indolyl acetic acid was used at concentrations of 0·5 to 4 parts per million with two mercurial dusts each containing 1·5 per cent. of mercury as ethyl mercury phosphate, applied at the rate of 2 oz. per bush. The treated seed was stored for six weeks before sowing. The mean figures for the results with both dusts were, no treatment 75·2 per cent. germination, dusts alone 59·1 per cent., and dusts plus 0·5, 1, 2, and 4 p.p.m. β indolyl acetic acid, 59·6, 59·5, 62·4, and 65·1 per cent. germination, respectively.

These results demonstrate that β indolyl acetic acid, when incorporated in a dust containing ethyl mercury phosphate, slightly reduces the adverse effect on the germination of wheat seed. The lower germination where β indolyl acetic acid was used at concentrations over the optimum does not support the view that the effects of the hormones are due to the reaction between the mercurial dusts and the added substances reducing the amount of active material in the dust, or to the mechanical grinding causing a loss of volatile components.

WILSON (W. E.). **Physiological studies on two species of Diplodia parasitic on Corn.**—*Phytopathology*, xxxii, 2, pp. 130–140, 1942.

In the writer's cultural studies at the University of Illinois on species of *Diplodia* parasitic on maize, viz., *D. zeae* and *D. macrospora*, with particular reference to their carbohydrate metabolism [*R.A.M.*, xvii, p. 238], the basic medium consisted of 0·25 gm. magnesium sulphate, 0·3 gm. potassium dihydrogen phosphate, 2 gm. potassium nitrate, 30 gm. of a carbohydrate, and distilled water to make up to 1 l.

A substance that enabled *D. macrospora* to develop in the presence of simple sugars was extracted from maize, oats, sugar beets, molasses, hyphae of the same pathogen from actively growing cultures, and a dextrose medium staled by *D. zeae*. Growth was further promoted by an invertase solution and a commercial biotin concentrate. The growth factor elaborated by *D. zeae* and present in a concentrate of dextrose media staled by the fungus is believed to be either biotin itself or a closely related

compound. Tests carried out on samples from various stages of the process whereby starch is converted to dextrose indicated that the growth factor contained in starch is not present to any significant extent in dextrose, but remains in the mother liquor removed from the latter after crystallization. The source of the maltose and sucrose added to the media exerted a marked influence on the growth of *D. macrospora*, the average mycelial contents per flask of 125 ml. on Pfanstiehl C.P. maltose and a brown technical maltose, for instance, being 30 and 427·1 mg., respectively, while similar variations were observed in connexion with sucrose, the average yield for substrata enriched with Baker's analysed C.P. sucrose, Coleman and Bell C.P. saccharose, C & H Pure Cane sugar from 2 lb. box, Domino Cube, and C. & W. Beet Sugar from 10 lb. bag being 41·1, 90·0, 48·1, and 27·8 mg., and very sparse, respectively. *D. zeae* on the other hand, grew equally well whatever the source of sucrose.

It is apparent from these results that many complex carbohydrates can only be utilized by *D. macrospora* if they contain in the form of an impurity an essential growth factor for the fungus, which is apparently removed from simple sugars during the manufacturing processes.

Edwards (E. T.). **The relation of mineral nutrition to seedling blight infection in Maize.**—*J. Aust. Inst. agric. Sci.*, vii, 4, pp. 147–154, 1 fig., 1941.

Experiments were carried out at the University of Wisconsin to determine the effect of nitrogen, phosphorus, and potassium nutrition on the growth of maize seedlings and on their infection by *Gibberella fujikuroi* and its var. *subglutinans* [*R.A.M.*, xix, p. 589; xxi, p. 72]. The effect of each element was studied separately, by varying its concentration in an otherwise constant nutrient solution, 7,200 potted seedlings being used. During the first two to three weeks' growth, the omission of any one of the three elements did not seriously affect growth. In sterile sand cultures to which only distilled water was supplied, satisfactory growth went on for 10 to 12 days at 24° and 28° C. It appears that maize grain contains sufficient reserves of essential nutrients to render the seedlings largely independent of external nourishment during the early stages of growth, which is precisely the critical period for infection by the fungi in question. It is therefore unlikely that soil fertility is a significant factor in the development of seedling blight diseases of maize.

Bain (D. C.). **Preliminary studies of a Sorghum leaf-spot in Louisiana.**—Abs. in *Proc. La Acad. Sci.*, vi, p. 48, 1942.

Sweet sorghum [*Sorghum saccharatum*] at Baton Rouge, Louisiana, was observed in the autumn of 1940 to be affected by a conspicuous foliar spotting caused by a fungus provisionally identified as *Titaeospora andropogonis* [*R.A.M.*, xii, p. 248], which was subsequently isolated also from Johnson grass [*S. halepense*] and from surface-sterilized seeds and glumes of diseased sorghum plants. This is apparently the first record of the fungus under observation in the United States, though its presence in China has been previously reported [loc. cit.]. An organism isolated by C. L. Le Febvre from Sudan grass [*S. sudanense*] at Arlington Farm, Virginia, in 1939 is also believed to be identical with *T. andropogonis*.

The pathogen sporulates profusely on the host and in culture, sclerotia likewise being produced under both conditions. In stained leaf sections, acervuli were observed to develop exclusively from the stomata. The optimum temperature for growth was found to be about 28° C. Infection was experimentally induced in one- and four-month-old sorghum seedlings in 16 and 24 hours, respectively.

Quinn (N. R.). **A chlorotic condition of Citrus trees.**—*Fruit World, Melbourne*, xliii, 1, pp. 13–14, 1942.

For some years past, citrus trees in many of the older groves of the Torrens Valley, South Australia, have shown a chlorotic condition somewhat resembling mottle leaf,

but differing from it in that the pattern is less clearly defined and the leaves do not show any conspicuous narrowing. In mature leaves the midrib and main veins are typically green, with a green margin of varying width on either side. The interveinal areas are lighter green, or may be yellowish. There is no noticeable reduction in leaf size. A preliminary spraying test in 1940–1 with commercial manganese sulphate having brought about a striking improvement in one case, another affected tree was sprayed in February, 1941, with a solution containing 2 per cent. of chemically pure manganese sulphate and calcium caseinate. Two months afterwards the sprayed foliage had become normal. More extensive tests are planned.

Pfältzer (A.) & De Fluiter (H. J.). **De wortelluisschimmel, Polyporus coffeae Wakef.** [The root louse fungus, *Polyporus coffeae* Wakef.]—*Arch. Koffiecult. Ned.-Ind.*, xv, 1, pp. 121–142, 7 figs., 1941. [English summary.]

This is a comprehensive study of the identity, geographical distribution, morphology, culture, life-history, and economic importance of *Polyporus coffeae* [*R.A.M.*, xiv, p. 31], the first reference to the occurrence of which in Java dates from 1911 (correspondence of the Malang Experiment Station), when it was, however, confused with the brown root fungus, *Fomes noxius*. The fruit bodies were not detected until 1936, at the same Station; in 1938 they were again observed on an estate in the Besoeki district. The coffee roots, which were parasitized by mealy bugs (*Pseudococcus deceptor* Gr.), were covered by a mycelial crust, mixed with soil particles and containing the organs described by Miss Wakefield (*Kew Bull.*, p. 308, 1917) as conidia, but probably more aptly termed chlamydospores. The sporophores are produced, not only round the collar of the tree, but also on the lateral roots. The genetic connexion between the mycelium and the sporophores was established by macroscopic examination, supplemented by pure culture on malt agar from basidiospores, which gave rise to the conidial stage of the fungus, *Bornetina corium*, thereby confirming Miss Wakefield's opinion and refuting that of Maublanc and Roger, who questioned the relationship [*R.A.M.*, xiv, p. 357]. *Polyporus coffeae*, which was found exclusively in symbiosis with *Pseudococcus deceptor*, did not appear, from observations extending over a period of 2½ to 5 years, to impair the health of the trees in any way, 85 per cent. falling into the 4 and 5 categories, i.e., assessed as 'good' and 'very good', respectively. In some cases eelworms (*Tylenchus pratensis* and *T. similis*) participate in the infestation of the trees, the state of which then does deteriorate, but there are no grounds for attributing even facultative parasitism to *Polyporus coffeae* itself.

Talley (P. J.) & Blank (L. M.). **Some factors influencing the utilization of inorganic nitrogen by the root rot fungus.**—*Plant Physiol.*, xvii, 1, pp. 52–68, 1 graph, 1942.

This is a detailed, tabulated account of the writers' laboratory studies at the Texas Agricultural Experiment Station on the factors affecting the utilization of inorganic nitrogen by *Phymatotrichum omnivorum* in synthetic nutrient solutions. Much of the information has already been noticed from another source [*R.A.M.*, xx, p. 75], but attention may be directed to the following points. The consumption of nitrate nitrogen is influenced by the balance between potassium and magnesium, both of which are tolerated over a wide range providing the ratio of one to the other is neither unduly high nor extremely low. To a limited extent calcium may be substituted for magnesium and sodium for potassium. Ammonium utilization is modified by the ionic balance in the solution, the uptake by the organism of this source of energy being promoted, for instance, by high magnesium and high phosphates and by high calcium or sodium and high sulphates or chlorine, whereas a combination of high magnesium and high sulphates or chlorine acted adversely on growth. *P. omnivorum* proved to be tolerant of nitrites and able to assimilate nitrite nitrogen.

Rogers (Ruth E.), Wheeler (Helen G.), & Humfeld (H.). **Physical and chemical changes produced in bleached Cotton duck by Chaetomium globosum and Spirochaeta cytophaga.**—*Tech. Bull. U.S. Dep. Agric.* 726, 35 pp., 2 pl., 2 figs., 1 diag., 12 graphs, 1940.

At the Bureau of Home Economics, United States Department of Agriculture, a bleached, de-sized, 14 oz. cotton duck was sterilized, inoculated with *Chaetomium globosum* [*R.A.M.*, xxi, p. 152 and next abstract] and a bacterium, *Spirochaeta cytophaga*, and then incubated on a mineral salts agar medium. Physical and chemical tests were made on samples of the fabric removed at intervals up to 15 and 18 days for the fungus and bacterium, respectively. Hyphal penetration into the fabric by *C. globosum* was shown by means of staining with basic fuchsin. During the period of perithecial and spore production by the fungus, i.e., between the third and seventh days, there was a decrease in carbon dioxide evolution, followed by a return to the initial rate and the attainment of a maximum about the tenth day, after which accumulation proceeded uniformly until the close of the test. Deterioration of the fabric by *C. globosum* was more rapid and complete than in the case of the bacterium, loss in weight, for instance, after nine days amounting to 15·4 and 6·8 per cent., respectively, while other properties impaired were breaking strength, thickness, and staple length, resulting in considerable breakage of the fibres.

Klemme (Dorothea E.). **A study of oxygen absorption and catalase production during growth of Chaetomium globosum on Cotton fibre and yarn.**—*J. Bact.*, xliii, 2, pp. 171–180, 2 figs., 3 graphs, 1942.

At the Bureau of Home Economics, United States Department of Agriculture, Sea Island cotton fibre and yarn manufactured therefrom were sterilized, inoculated with *Chaetomium globosum* (which is stated to have been found on nearly all the samples of awnings, tarpaulins, shock covers, tents, and the like examined in the laboratory of the above-mentioned institution) [see preceding abstract], and incubated for 28 days in a Warburg apparatus. In both materials the daily oxygen consumption reached a maximum at about the eleventh day, after which the rate decreased (almost imperceptibly from the 18th to the 28th). Coinciding with the production of perithecia by the fungus, there was a slight fall in the rate of oxygen absorption on yarn between the fifth and eighth days, followed by a renewed increase until the attainment of the peak. The amount of oxygen absorbed by *C. globosum* on the fibre sample was significantly greater than that consumed by the yarn (0·32 milli-equivalents per gm. as compared with 0·21). Corresponding to these differences was a much more extensive output of catalase on the fibre than on the yarn, indicating the superiority of the former as a substratum for the fungus. It was further shown by preliminary experiments that the organisms growing on unsterilized, uninoculated samples of Acala cotton fibre consumed a materially larger quantity of oxygen than those present on unbleached cotton fabric, denoting that raw cotton is likely to deteriorate more rapidly than yarn or fabric in a moist atmosphere.

Charles (Vera K.). **A preliminary check list of the entomogenous fungi of North America.**—*Insect Pest Surv. Bull., U.S.*, xxi, 9 (*Suppl.*), pp. 707–785, 1941. [Mimeographed.]

The data presented in this provisional catalogue of the entomogenous fungi (excluding the Laboulbeniaceae) of the North American Continent (including Central America and the West Indies) are based primarily on an index of these organisms which has been maintained for many years as part of the mycological collections of the Bureau of Plant Industry. Annotated lists, arranged in alphabetical order, are given of (a) the fungi with their hosts and distribution, and (b) the insects with the fungi parasitic on each species. A four-page bibliography of selected references to the relevant literature is also included.

Masera (E.). **Miceti patogeni al Bombyx mori L.** [Fungi pathogenic to *Bombyx mori* L.]—*Riv. Parassitol.*, iv, pp. 51–60, 1940. [Abs. in *Zbl. Bakt.*, Abt. 1 (Ref.), cxl, 11–12, pp. 238–239, 1941.]

Besides being subject to spontaneous infection by *Beauveria bassiana* and *B. globulifera*, silkworms (*Bombyx mori*) [*R.A.M.*, xviii, pp. 521, 735] at the Padua Silk-Growing Experiment Station were successfully inoculated with *Spicaria fumosorosea* [ibid., xviii, p. 532], *Metarrhizium anisopliae* [ibid., xviii, p. 380], *Sporotrichum paranense* [ibid., xvi, p. 530], and *B. densa* [ibid., xx, p. 301].

Pardo-Castello (V.), Leon (E. R.), & Trespalacios (F.). **Chromoblastomycosis in Cuba.**—*Arch. Derm. Syph., Chicago*, xlv, 1, pp. 19–31, 6 figs., 1942.

The writers report 31 cases of chromoblastomycosis in Cuba, where the disease falls into five distinct clinical types: all the patients except one were farmers, mostly between 40 and 60 years of age. Pure cultures were obtained from 11 cases on Sabouraud's agar and other standard media, on which the causal organism agrees with the published descriptions of *Fonsecaea* (*Acrotheca*, *Hormodendrum*, *Gomphinaria*) *pedrosoi* [*R.A.M.*, xxi, p. 14]. The colonies are dark green or brown to black, and the long, regularly septate, branched hyphae measure 2 to 6 μ in diameter, some producing apically or laterally a row of three or four dark, round, thick-walled cells, 10 to 14 μ in diameter, closely resembling the 'sclerotia' found in sections of tissue and in the scales and pus. Arthrospores of varying dimensions developed in all the cultures after four days. According to the substratum, the circular, oval, or elliptical conidia measure 1 to 6 μ in diameter (up to 8 μ on Czapek's medium), and may be grouped in clusters of a few to several hundred on concatenate conidiophores of variable shape and size with or without septa. Phialides occurred in one culture only.

Hooper (K. H.) & Wannan (J. S.). **Torulosis in Queensland.**—*Med. J. Aust.*, xxviii (ii), 24, pp. 669–671, 7 figs. (6 in *Suppl.*), 1941.

In 1941, at the Department of Health, Brisbane, *Debaryomyces hominis* [*D. neoformans*] was isolated on Sabouraud's maltose agar at 37° C. from the cerebrospinal fluid during the lifetime of the patient, a 57-year-old woman who succumbed to the disease about six weeks after its onset [cf. *R.A.M.*, xx, p. 578]. The fungus was shown to be pathogenic to mice, in the brains of which it produced the gelatinous cystic masses characteristic of Benham's group III of *Cryptococcus* [ibid., xv, p. 153]. This is apparently the first case of the disease to be reported from Queensland and the sixth record for Australia.

Warvi (W. N.) & Rawson (R. W.). **Torula meningitis.**—*Arch. intern. Med.*, lxix, 1, pp. 90–98, 2 figs., 1942.

A case of fatal *Torula* meningitis [*Debaryomyces neoformans*: see preceding abstract] complicating Hodgkin's disease in a 39-year-old male patient at the Collis P. Huntington Memorial Hospital, Boston, Massachusetts, is fully reported, this being the eighth record of an association between the two maladies in question. A perusal of the relevant literature indicates that a diagnosis of torulosis is to be suspected in cases of otherwise inexplicable progressive intracranial disease, confirmation being obtained by studies of the spinal fluid, with identification of the fungus either by culture or animal inoculation, the latter method having been used by the authors. The organisms observed in process of budding in the leptomeninges of the patient measured 2 to 14 μ in diameter and consisted of a central round body and a mucoid capsule, the former staining orange and the latter blue with Mallory's aniline reagent.

Baker (E. E.) & Smith (C. E.). **Utilization of carbon and nitrogen compounds by Coccidioides immitis.**—*J. infect. Dis.*, lxx, 1, pp. 51–53, 1942.

In experiments at the Stanford University School of Medicine, San Francisco, the

following were among the carbon sources utilized by *Coccidioides immitis* [*R.A.M.* xx, p. 577] on a basal medium consisting of 2 gm. each of primary and secondary potassium phosphates, 0·5 gm. magnesium sulphate, and 0·1 gm. ferric chloride in 1,000 c.c. distilled water: glucose, fructose, mannose, galactose, xylose, maltose, cellobiose, trehalose, α-methyl glucoside, salicin, amygdalin, starch, dextrin, inulin, ethanol, glycerol, erythritol, mannitol, sorbitol, the acetate, propionate, caproate, lactate, pyruvate, succinate, fumarate, and malate of sodium, glycine, alanin, acetamide, and asparagin. Nitrogen was furnished by ammonium chloride, potassium nitrate, urea, acetamide, asparagin, glycine, alanine, glutamic acid, tyrosine, cystine, and peptone.

Reid (J. D.), Scherer (J. H.), Herbut (P. A.), & Irving (H.). **Systemic histoplasmosis.**—*J. Lab. clin. Med.*, xxvii, 4, pp. 419–434, 14 figs., 1942.

A full account is given of the clinical and mycological aspects of a fatal case of systemic histoplasmosis in a 38-year-old negro, a patient at the St. Philip Hospital, Richmond, Virginia, in whom the diagnosis was made during life by the isolation of *Histoplasma capsulatum* [*R.A.M.*, xxi, p. 255] from the blood (10 c.c. per flask) on a medium consisting of veal infusion broth with 0·3 per cent. dextrose, 0·5 per cent. sodium citrate, and 0·2 per cent. agar (P_H 7·4). After 12 days' incubation at 37° C. the oval or occasionally circular yeast-like bodies appearing in large numbers were found on staining with Wright's reagent to be almost identical with, though slightly larger (2·7 to 3·6 μ in diameter) than those occurring in the tissue cells; they were occupied by a dark-staining, chromatin-like mass. Subcultures were made on Sabouraud's dextrose agar, dextrose extract agar, brain veal agar, and sealed brain veal blood agar slants in two series, one maintained at 37° and the other at room temperature. Growth developed first on Sabouraud's agar and dextrose extract agar at room temperature, the small, white, downy colonies gradually enlarging and producing white, feathery hyphae turning brown with age. Wet preparations from these colonies revealed a branched hyaline, septate mycelium, 2 to 5 μ in diameter, containing many dark, dancing granules, while smooth-walled arthrospores, 8 to 13 μ in diameter, were produced from stalks along the hyphae or at the ends of the branches. On sealed blood agar slants and in semi-solid media containing fresh blood at 37° the fungus tended to develop in the yeast-like stage, the gross appearance of the growth being of dull greyish-yellow colonies adhering firmly to the substance.

The experimental production of histoplasmosis in guinea-pigs is described, and the pathological morphology of the fungus in the case under observation discussed in relation to the differential diagnosis of the disease.

Cohen (V. L.). **The content of fungous spores in the air in Buffalo, New York.**—Abs. in *J. Bact.*, xliii, 1, pp. 115–116, 1942.

With a view to the establishment of a relationship between the identity and incidence of air-borne fungi [*R.A.M.*, xxi, p. 255] and (a) seasonal conditions, (b) fluctuations of atmospheric temperature and humidity at Buffalo, New York, Petri plates of Sabouraud's agar were exposed for half-an-hour at bi-weekly intervals throughout 1940, the cultures being determined and counted after three days' incubation at room temperature. Species of *Hormodendrum* were found to predominate from March to December, with a peak in July; *Alternaria* from May to December (August); *Penicillium* from March to May and October to December (April and November); *Phoma* from March to August and September to December (May and November); *Mucor* from February to July and August to December (April and November); *Fusarium* from June to November (August); *Phycomyces* from May to November (June); *Hyalopus* in January and February, especially the former; *Monilia* from June to September (July); and *Cephalothecium* [? *Trichothecium*] from January to March and October to December (February and November), while *Aspergillus* developed

sporadically throughout the year. No connexion was apparent between atmospheric fluctuations and the prevalence of the different organisms.

Heggeness (H. G.). **Effect of borax applications on the incidence of rust on Flax.**—*Plant Physiol.*, xvii, 1, pp. 143–144, 1942.

Further details are given on the control of flax rust (*Melampsora lini*) at the Minnesota Agricultural Experiment Station [*R.A.M.*, xxi, p. 256]. The disease was completely controlled by the application on 9th May, 1941, of borax at the rate of 60 lb. per acre. Zinc sulphate and calcium nitrate (30 and 120 lb. per acre, respectively), applied separately, not only failed to control the disease, but actually aggravated its severity, whereas in combination with borax (60 lb.) they gave absolute control. The same treatments were applied on 16th June with similar, though less markedly beneficial, results.

Dufrénoy (J.). **Changes in the structure of the cells induced by the 'yellow spot' virus disease of Easter Lilies.**—*Proc. La Acad. Sci.*, vi. p. 35, 1942.

The long epidermal cells of externally healthy Easter lily [*Lilium longiflorum*] leaves infected by the yellow flat [or rosette] virus [*R.A.M.*, xix. p. 517] reacted to treatment with the molybdenum blue stain by the differentiation of the mitochondria into flexuous threads, running parallel with the cytoplasmic strands radiating from the nucleus between some large vacuoles. In the shorter cells of the stunted, discoloured foliage affected by the disease, the mitochondria were disposed in rows of small rods along the cytoplasmic strands. The refringent honeycomb-like structure produced by this arrangement is thought to correspond to the 'X' or vacuolated bodies described by various workers engaged on the study of viruses.

Wilson (R. D.). **Black rot of garden Stocks.**—*Agric. Gaz. N.S.W.*, liii, 1, pp. 33–35, 55, 1 fig., 1942.

Black rot of garden stocks [*Matthiola incana*], stated to be caused by a strain of *Bacterium campestre* [*Xanthomonas campestris*], first recorded in New South Wales in 1938 [*R.A.M.*, xviii, p. 256], has become the most important disease of this popular ornamental plant found in the State, and one of the most serious with which commercial flower-growers have to contend. Seed-borne, the disease spreads with great rapidity under seed-bed conditions, and this spread, resulting from the use of diseased seed, is held responsible for the high percentage of infections observed during the past three years in many commercial plantings. Sowings made early in the season (December and January) are generally more seriously attacked than later ones, grown when the prevailing temperatures are lower.

Tests were carried out in which seed was submitted to different treatments, including (1) dusting with ceresan (UT 1875a) at the rate of 2 parts by weight to 1,000 parts by weight of stock seed, (2) dusting with excess ceresan and sieving off the excess dust, (3) dipping for 10 and 30 minutes in a 1 in 1,000 solution of mercuric chloride at room temperature, (4) hot-water treatment at 122° and 127·4° F. for 10 and 30 minutes and (5) treatment with bleaching powder (calcium hypochlorite) by four hours' immersion in a 7 per cent. solution at room temperature, 4, 16, and 24 hours' immersion in a 10 per cent. solution at room temperature, and four hours' immersion in a 10 per cent. solution at 61·7°, 68°, 77·9°, 86°, and 98·6°. Both the treated seed and the controls were sown either in outside seed-beds (in some instances the soil being sterilized with formalin) or in pots of steam-sterilized soil in a glasshouse.

The results obtained may be summarized as follows. The two ceresan dust treatments and the 10-minute hot-water treatment at 122° were ineffective. The two mercuric chloride treatments and the 10-minute hot-water treatment at 127·4° gave some control. The two 30-minute hot-water treatments and all the bleaching powder treatments gave considerable (possibly complete) control.

All the hot-water treatments severely affected germination. This effect was more

pronounced in the seed-beds than in the glasshouse. Injury was very marked on old seed. Thus, 30 minutes' immersion at 127·4° of three-year old seed gave only 8 per cent. germination, as against 49 per cent. for the control. On seed which was 1½ years old the same treatment under glasshouse conditions reduced germination to 66 per cent., as compared with 81 per cent. in the controls (average of three experiments). The 10 and 30 minutes' dipping in mercuric chloride reduced germination under glasshouse conditions to about the same extent as the hot-water method, but the effects were less severe outdoors.

The 16 and 24 hours' treatments in 10 per cent. bleaching powder solution at room temperature reduced germination to about 10 per cent. of that of the untreated seed. The four hours' treatment in 10 per cent. bleaching powder solution at 98·6° reduced germination from 83 per cent. (untreated) to 22 per cent.; none, however, of the other four hours' treatments had any seriously adverse effect, and provided the temperature of the liquid is kept below 86° it seems unlikely that serious effects would follow four hours' treatment in a 10 per cent. solution of bleaching powder.

The control measures recommended consist in the use of clean seed (directions for growing which are given), and of clean soil for the seed-bed (i.e., soil not previously bearing diseased stocks, or soil sterilized by heat or formalin), and crop sanitation; affected plants should be pulled up and burned, and land where diseased stocks have grown should not be planted again to this crop for at least four or five years. If the seed is of doubtful or unknown origin it should be treated for four hours in a 10 per cent. bleaching powder solution at a temperature not exceeding 85°. If practicable, the seed should be sown directly in the field, and not planted in a seed-bed.

Tompkins (C. M.) & Middleton (J. T.). **Root rot of Ranunculus asiaticus caused by Pythium debaryanum.**—*J. agric. Res.*, xliv, 3, pp. 179–183, 2 figs., 1942.

During the winter of 1937–8, Persian buttercups (*Ranunculus asiaticus*) in commercial field-plantings at Inglewood and Pacific Palisades, California, were observed to be affected by a destructive root disease. The disease was also found subsequently in Santa Cruz, San Mateo, and San Francisco counties.

The chief symptoms are general wilting and subsequent rapid collapse and death. The roots, tubers, stems, and petioles may all be infected. The roots and tubers of affected plants are dark brown, water-soaked, and flaccid. The stem plate is discoloured and dark, but not, as a rule, water-soaked or flaccid. Occasionally the petioles are attacked, the affected parts being dark brown, often with necrotic streaks 1 to 3 mm. wide, and about 30 to 60 mm. long, extending outwards from the base of the petiole, and parallel to its long axis. In the field, plants are generally affected when 6 to 8 in. high. The disease appears on widely different soil types, and is favoured by heavy rainfall or irrigation, poor drainage, cool weather, and overcrowding.

Isolations from affected material consistently yielded *Pythium de Baryanum*, the morphology of which is briefly described. Four isolates from different areas were studied. Their minimum, optimum, and maximum growth temperatures were, respectively, 1°, 28°, and 37° C. All four were pathogenic to healthy *Ranunculus* plants grown from seeds and tubers in inoculated soil, the incubation period ranging from 11 to 25 days; all the infected plants died a day or two after the foliage had begun to wilt. Of 20 plants inoculated with each isolate, none escaped infection, though the 20 controls remained healthy. The re-isolates were also highly pathogenic. The infected plants showed symptoms identical with those observed under field conditions.

In greenhouse tests on 46 species of plants the fungus was found to be pathogenic (no-wound technique) only to young plants of Iceland poppy (*Papaver nudicaule*), columbine (*Aquilegia caerulea*), fibrous-rooted begonia (*Begonia semperflorens*), butterfly flower (*Schizanthus pinnatus*), and cucumber. Control consists in the selection of well-drained sites for planting.

Johnson (F.). **The complex nature of White-Clover mosaic.**—*Phytopathology*, xxxii, 2, pp. 103–116, 2 figs., 1942.

It has recently been shown that white clover (*Trifolium repens*) mosaic is induced by a mixture of two distinct viruses, namely pea mottle and pea wilt viruses, the former alone being transmissible by dodder (*Cuscuta campestris*) and the latter infecting cowpea, which is resistant to mottle [*R.A.M.*, xx, p. 590]. A combination of the two viruses, transferred to peas induced symptoms of streak and killed the plants in the same way as the *Trifolium* virus 1 complex. Pea mottle virus alone caused a systemic mosaic disease in a number of pea varieties, and was further pathogenic to various plants in different families, e.g., *Stellaria media*, spinach, cucumber, sweet pea, lentil, lupin, lucerne, *Medicago lupulina*, *Melilotus alba*, *Phaseolus vulgaris*, *T. hybridum*, *T. incarnatum*, *T. pratense*, *T. repens*, broad bean, vetch, and *Antirrhinum majus*. Pea wilt, on the other hand, infected only members of the Leguminosae in a comparatively mild form and induced no mottling in peas, except for a very mild mosaic in Alaska and Canada White. No intracellular inclusion bodies were found in plants attacked by either virus, nor was transmission of the infective principle secured by the alternate feeding of the pea aphid (*Macrosiphum pisi*) on diseased and healthy pea plants.

The pea mottle virus succumbed to ten minutes' exposure to a temperature of 60° to 62° C., while the agent of wilt was inactivated by the same period at 58° to 60°. The infectivity of the pea mottle virus was maintained in a dilution of 1 part in 10,000 of water, the corresponding tolerance of wilt being in 1 in 100,000. Both viruses withstood ageing *in vitro* and in dried host tissues for a minimum of 31 days and were filterable through a Berkefeld W filter.

The names *Marmor efficiens* and *M. repens* are proposed for the pea mottle and wilt viruses, respectively.

Gould (C. J.). **Diseases of cultivated Lupines.**—*Proc. Iowa Acad. Sci.*, xlvi (*1939*), pp. 119–125, 1940.

Brief accounts are given of the economic importance, geographical distribution and symptoms of eight major diseases of lupins, viz., (1) leaf spot (*Ceratophorum setosum*) [*R.A.M.*, xix, p. 99], (2) stem necrosis (*Ascochyta pisi* and other *A.* spp.), (3) damping-off and wilting (*Rhizoctonia* [*Corticium*] *solani*), (4) and (5) wilts due to *Sclerotinia sclerotiorum* and *Thielavia* [*Thielaviopsis*] *basicola* [ibid., xix, p. 657], (6) lime-induced chlorosis [ibid., xvi, p. 42], (7) sore shin (pea virus 2) [ibid., xv, p. 510 *et passim*], and (8) browning (cucumber virus 1) [ibid., xviii, p. 803], of which Nos. 2 to 5, inclusive, have been reported from the United States. Notes are also given on the essential features of ten minor disorders, among which may be mentioned *Collybia velutipes* and *Pleurotus ostreatus*, destructive wound parasites of *Lupinus arboreus*, a valuable soil retainer on sand dunes near San Francisco [ibid., xix, p. 658], and tomato spotted wilt, affecting lupins in the United States [ibid., xix, p. 657] and England. For the most part, the control measures advocated against lupin diseases are based on the use of resistant varieties.

Fischer (G. W.). **Infection of forage grasses with flag smuts of Wheat, Rye, and grasses (Urocystis tritici, U. occulta, and U. agropyri, respectively).**—Abs. in *Phytopathology*, xxxii, 1, pp. 4–5, 1942.

The inoculation [? at the Washington Agricultural Experiment Station] of 32 species of *Agropyron*, *Elymus*, *Hordeum*, and *Sitanion* with spores of the wheat, rye, and grass flag smuts (*Urocystis tritici*, *U. occulta*, and *U. agropyri*, respectively), induced the development of typical symptoms as follows: *U. tritici* infected *Agropyron caninum*, *A. repens*, *A. spicatum*, *A. semicostatum*, *Elymus glaucus*, and *E. triticoides*; *U. occulta* attacked *A. caninum*, *A. inerme*, and *E. canadensis*; and *U. agropyri*

(from *Hordeum nodosum*) was pathogenic to *A. caninum* and *E. canadensis*. *U. tritici* and *U. agropyri*, being virtually identical in their morphological characters, should be regarded as races of the same species, to be designated, on grounds of priority, *U. agropyri*. A differential feature of *U. occulta* is the less complete investment of the spores by the sterile cells. The established susceptibility of grasses to wheat flag smut and the morphological identity of the wheat and grass pathogens afford a plausible explanation of the source of epidemics of *U. tritici* on wheat in the United States, where flag smut has long been known to involve a wide variety of grasses from coast to coast.

Fischer (G. W.). **Comparative value of certain popular fungicidal dusts in control of head smut (Ustilago bullata) and in improvement of stands in forage grasses.**—Abs. in *Phytopathology*, xxxii, 1, p. 5, 1942.

Various dusts were tested at the Washington Agricultural Experiment Station for the control of smut (*Ustilago bullata*) [*R.A.M.*, xx, p. 536] on *Agropyron trachycaulum*, *Bromus marginatus*, *B. catharticus*, *Elymus canadensis*, *E. glaucus*, and *Hordeum nodosum*. Only 2 per cent. ceresan and new improved ceresan gave satisfactory results, the treated stands excelling the untreated checks by 300 to 500 per cent. The recommended concentrations for the two effective preparations are 2 to 4 and ½ to 1 oz. per bush. of seed, but no reduction in stand, except in the case of *H. nodosum*, followed their use in considerable excess (two to four times the appropriate strength).

Atkinson (J. D.) & Taylor (G. G.). **Experimental spray work on the Havelock North orchard.**—*N.Z.J. Sci. Tech.*, A, xxiii, 1, pp. 9-12, 1941.

The results of further experiments (up to the season of 1940–1) fully confirmed those of tests already reported as regards the efficacy of the standard spray schedule of the (New Zealand) Plant Diseases Division for the control of apple black spot [scab] (*Venturia inaequalis*) and mildew (*Podosphaera leucotricha*) [*R.A.M.*, xxi, p. 144]. Pear scab [*V. pirina*], though less amenable to treatment than the corresponding apple disease, also showed signs of yielding to a systematic spraying programme.

Magness (J. R.). **Apple varieties and important producing sections of the United States.**—*Fmrs' Bull. U.S. Dep. Agric.* 1883, 32 pp., 2 figs., 3 maps, 1941.

This bulletin comprises a brief review of the salient climatic and topographical features of the chief apple-growing sections of the United States, a discussion of the pathological agencies and conditions affecting the crop in the different districts under observation, and a description of the characteristics of the leading varieties.

Herman (F. A.). **Spray retention: amounts of arsenic and sulphur retained employing spray compositions.**—*Canad. Chem. Process Industr.*, xxv, 10, pp. 526–527, 1 graph, 1941.

At the Kentville Experiment Station, Nova Scotia, collections of leaves from 11 plots of 8 to 12 average-sized Stark apple trees were made immediately after the last treatment with a combined arsenic and sulphur spray (against insect injury and scab [*Venturia inaequalis*]), and at fortnightly intervals thereafter during the growing season. The initial reduction in the arsenic content of the foliage was rapid on the plots receiving the higher applications of flotation sulphur (15 or 20 lb. per 100 gals.), as well as where hydrated lime and calcium arsenate were constituents of the spray. In general, the reduction of residual sulphur was rapid during the first fortnight except in plot 13, treated with lime-sulphur (1 to 1½ gal.), iron sulphate (6 lb.), and white arsenic (¼ to 1 lb.) per 100 gals., in which the drop was only from 151 to 136 mg. per 50 leaves, compared, e.g., with a fall from 115 to 44 mg. in plot 2, given 15 lb. ferrox flotation sulphur, 3 lb. calcium arsenate, and 6 lb. hydrated

lime. At the fifth collection on 6th September, the amount of sulphur (in mg. per 50 leaves) in plot 13 was 30, the corresponding figure for plot 2 being 11, and for plots 1 (1 gal. lime sulphur, 4 lb. magnetic catalytic sulphur, and 3 lb. lead arsenate), 4 (15 lb. Koppers flotation sulphur and 3 lb. lead arsenate), 5 (10 lb. magnetic '70' and 3 lb. lead arsenate), 6 (8 lb. flotox wettable sulphur, 1 pint orthex spreader, and 3 lb. lead arsenate), 8 (20 lb. ferrox flotation sulphur and 3 lb. lead arsenate), 9 (15 lb. ferrox flotation sulphur and 3 lb. lead arsenate), 10 (10 lb. ferrox flotation sulphur and 3 lb. lead arsenate), 11 (15 lb. ferrox flotation sulphur and 10 lb. black leaf 155), and 12 (15 lb. ferrox flotation sulphur and 3 lb. cryolite) being 16, 17, 54, 15, 48, 18, 17, 40, and 29, respectively.

The incidence of scab in plots 1, 2, 4, 5, 6, 8, 9, 10, 11, 12, and 13 was 0·53, 0·78, 0·6, 0·71, 0·86, 0·93, 0·73, 1·33, 1·65, 1·23, and 1·93 per cent., respectively, compared with 78·85 in the untreated control plot.

GERHARDT (F.). **Simultaneous measurement of carbon dioxide and organic volatiles in the internal atmosphere of fruits and vegetables.**—*J. agric. Res.*, lxiv, 4, pp. 207–219, 2 figs., 1 graph, 1942.

Using a method evolved by combining a modification of the extraction technique of Wardlaw and Leonard (*Ann. Bot., Lond.*, N.S., iii, pp. 27–42, 1939) for the removal of carbon dioxide from internal atmospheres with Gerhardt and Ezell's technique for the absorption of volatile atmospheres from stored fruit [*R.A.M.*, xx, p. 412], the writer found that the oiled paper (18·7 per cent. oil) employed in the wrapping of stored apples (Delicious variety in these tests) contained 35·37 mg. volatiles per wrap compared with only 3·82 mg. for plain paper. In other words, the oiled paper took up about ten times as much of the volatile emanations from the fruit as did the plain wrap.

Ripening processes induced a much greater change in the internal atmosphere of Bartlett pears than in that of Delicious apples. Severe scald developed in the pears after a week at 65° F. and may have been closely associated with a heavy increase in acetaldehyde during maturation. The soft-scalded tissues of Jonathan apples were found to contain slightly less carbon dioxide than normal ones, whereas the total volatile content of the former was some five times that of the latter. Other factors beside acetaldehyde accumulation must obviously be concerned in the multiplication of total volatiles in the soft-scalded tissues, since this compound comprises a similar percentage (13 and 16, respectively) of the total volatiles in both soft-scalded and sound tissue. In this connexion it may be noted that the development of off-flavour in Delicious and of soft scald in Jonathan apples was accompanied by copious accumulations of total volatiles, represented in the former case largely by acetaldehyde, whereas in the latter other types were involved.

BODINE (E. W.). **Antagonism between strains of the Peach-mosaic virus in western Colorado.**—Abs. in *Phytopathology*, xxxii, 1, p. 1, 1942.

Definite indications of antagonism between the several strains of the peach mosaic virus occurring in western Colorado [*R.A.M.*, xx, p. 370] have been observed. Thus, an Elberta tree affected by the slight strain, when re-inoculated with buds of the severe strain in the autumn of 1938, developed only slight strain symptoms in the following spring. After the insertion of buds from the re-inoculated tree into healthy Elbertas in the autumn of 1939, of the 18 successful grafts ten showed symptoms of the slight strain during the following spring, the remainder being very little or not at all affected. Ten of the inoculated trees, five with and five without definite slight strain symptoms, were re-inoculated with the severe strain in the spring and autumn of 1940. In the spring of 1941, each tree exhibited only the symptoms already shown in 1940. The remaining eight trees serving as controls likewise manifested the same symptoms as in 1940.

STODDARD (E. M.). **Inactivating in vivo the virus of X-disease of Peach by chemotherapy.**—Abs. in *Phytopathology*, xxxii, 1, p. 17, 1942.

In 1941, eight out of ten peach buds infected by the X-disease virus [*R.A.M.*, xxi, p. 28] failed to develop the symptoms of the trouble after immersion in quinhydrone as compared with one in the untreated controls and none in some of the other chemicals tested. A lesser degree of inactivation was obtained under comparable conditions by the use of 8-hydroxyquinoline sulphate, hydroquinone, paranitrophenol, calcium 8-hydroxyquinolate, urea, sodium thiosulphate, and some of their derivatives. For instance, to date, buds soaked in 1940 in urea, calcium 8-hydroxyquinolate, magnesium 8-hydroxyquinolate, ortho-nitrophenol, or sodium thiosulphate have remained healthy.

Here are spray recommendations for orchards of western States.—*Bett. Fruit*, xxxvi, 8, pp. 5, 23–25, 1941.

A conference of the Western Co-operative Spray Project held in Portland, Oregon, in January, 1942, reported, *inter alia*, that lime-sulphur (2 gals. to 100 gals. water) and ferric dimethyldithiocarbamate (1½ lb. plus 1½ lb. hydrated lime) have both given satisfactory control of cherry leaf spot [*Coccomyces hiemalis*] on sour cherries when applied at petal fall, shuck fall, and two weeks later.

SLATE (G. L.), SUIT (R. F.), & MUNDINGER (F. G.). **Raspberry growing in New York: culture, diseases, and insects.**—*Circ. N.Y. St. agric. Exp. Sta.* 153, 57 pp., 12 figs., 1940.

This circular, originally published in 1934, contains a section (pp. 22–48) on virus, fungal, bacterial, and physiological diseases affecting the raspberry crop in New York State [cf. *R.A.M.*, xii, p. 640], those of the first-named group being the most fully treated.

ATKINSON (H. J.) & WRIGHT (L. E.). **Studies on some Raspberry soils of British Columbia.**—*Sci. Agric.*, xxii, 5, pp. 287–297, 1942.

After referring to earlier investigations into raspberry failure in the Fraser River Valley, British Columbia [cf. *R.A.M.*, xii, p. 678; xvi, p. 47], the authors describe chemical studies made on nine samples of soil from areas in this locality in some of which raspberry growth had been good, while in the remainder it was unsatisfactory. The points dealt with included P_H value, carbon and nitrogen content, available phosphorus, water-soluble phosphates and boron, water-holding capacity, exchangeable bases, displaced soil solution, proximate analysis of the organic matter fraction, and the effect of sterilization on most of these values.

Of all these factors, the only one that appeared to show a relationship with the level of raspberry growth was boron content. The samples from all the areas where raspberry growth was poor showed under 0·2 p.p.m. of boron, while those from all the good areas showed 0·25 p.p.m. or more; the sample from the one area marked 'excellent' showed the highest value of all, 0·37 p.p.m.

TIMS (E. C.) & BONNER (FRANCES). **Studies of Fig leaf blights.**—*Proc. La Acad. Sci.*, vi, pp. 13–34, 1 pl., 1942.

Three apparently distinct fungi responsible for fig leaf blights in Louisiana, namely, *Corticium stevensii*, *C.* (*Rhizoctonia*) *microsclerotia* [*R.A.M.*, xix, p. 294; xxi, p. 67], and an undetermined *C.* species were compared with *C. solani* and *C. koleroga* from coffee [ibid., xiv, p. 795]. In cultures on string bean agar, *C. stevensii* and *C. koleroga* grew relatively slowly, the average daily increase in the diameter of their colonies at the

optimum temperature of 24° C. being only 7·3 and 8·5 mm., respectively, as against 40, 45, and 35 mm., respectively, for *C. microsclerotia*, *C. solani*, and the unidentified *C.* sp. at their optimum of 28°. Many other cultural differences between the five species were observed on bean, potato dextrose, prune, onion, and Czapek's agars at 28°, but only a brief résumé of the results of these studies is given by the authors. Definitely organized sclerotia were produced only by *C. microsclerotia* and *C. stevensii*, *C. solani* and the undetermined *C.* sp. forming masses of irregular, somewhat flattened sclerotium-like aggregations, while *C. koleroga* developed no sclerotia but gave rise to an abundant mycelium ranging from oyster-white to beige or chamois-colour according to the substratum. The growth characters of the two closely related species, *C. stevensii* and *C. koleroga*, are presented in tabular form; the colour of the sclerotia of the former, which were most profuse on potato dextrose, prune, and onion agars, varied between beige and Italian straw.

In inoculation experiments on fig leaves under favourable conditions of warmth and humidity, all five species proved to be more or less destructive, especially the three faster-growing ones, which were capable of killing the foliage three days from the onset of infection. *C. stevensii* and the unidentified *C.* sp. formed basidial mats with spores on the lower surfaces of some inoculated leaves, the average length of the basidiospores of the former ranging from 10·4 to 10·8 and the width from 4·3 to 4·8 μ, while the corresponding figures for the latter were from 7·5 to 8·7 and 4·5 to 5·5 μ, respectively. The blunt, stout basidiospores of the undetermined *C.* sp. afforded an easy means of differentiation from the long and narrow ones of *C. stevensii*, but the other species produced basidia rarely or not at all.

The evidence accumulated in these investigations is considered to point to the maintenance of *C. koleroga* and *C. stevensii* as distinct species.

Further experiments in 1940 and 1941 with the mixture of 1·5 per cent. copper sulphate, 1 per cent. lime and zinc arsenite, 0·25 per cent. monocalcium arsenite, and 1 per cent. fish oil used in earlier trials [loc. cit.] gave fairly successful results, though considerable post-harvest defoliation was caused by *C. microsclerotia* and the undetermined *Corticium*.

Successful stationary spray plant.—*Fruit World, Melbourne*, xlii, 12, p. 6, 1 fig., 1941.

Brief details are given of an electrically driven stationary spray plant recently installed in one of the largest pear orchards in Victoria [cf. *R.A.M.*, xix, p. 295]. The pipes were reticulated from the mixing shed throughout the orchard to taps, from each of which a maximum of 35 trees is sprayed by means of 80 ft. of hose. The power for spraying is supplied by a 7½ h.p. electric motor. The power cost of spraying amounted to only 1s. 1½d. per 1,000 gals., as against a fuel cost of 3s. 4d. per 1,000 gals. for the old type with horse-drawn carts, the smaller figure also including the cost of pumping the water into the vats. Installation costs were £13 per acre.

Heuberger (J. W.) & Turner (N.). **A laboratory apparatus for studying settling rate and fractionation of dusts.**—*Phytopathology*, xxxii, 2, pp. 166–171, 2 figs., 1942.

An apparatus is described for use in the study of the settling rate and fractionation of insecticidal and fungicidal dusts, features of which include a settling tower of simple design, an exposure chamber for the serial exposure of slides or leaves to the dust cloud in the tower, a dust magazine (charge tube) for the instantaneous and complete discharge of the test material by an air blast, and a convenient mechanism for the introduction of known charges of dust into the settling tower. Tables are given showing the consistency of the data thus obtained at the Connecticut Agricultural Experiment Station in exposures of 30 seconds with four copper dust mixtures, and of five seconds with four diluents, viz., aplite, Cherokee clay, pyrax ABB, and Volclay bentonite 200M.

Felix (E. L.). **Tetrachloro-para-benzoquinone, an effective organic seed protectant.**—Abs. in *Phytopathology*, xxxii, 1, p. 4, 1942.

In 41 greenhouse tests spergon, a commercial preparation containing 99 per cent. tetrachloro-para-benzoquinone as the active ingredient, was applied to peas [*R.A.M.*, xxi, p. 245] at a dosage of 0·25 per cent. of the seed weight. Ten days after planting the mean difference in stand was 52·9 per cent. and in plant height 0·85 cm. in favour of the treated samples. Active dosage of 0·125 per cent. of the seed weight in diluted and undiluted form yielded a somewhat thinner stand than the higher rate, though the plants of the former series were slightly taller. The efficacy of spergon was not impaired by the admixture of derris root containing 5 per cent. rotenone, indicating the apparent compatibility of the two disinfectants. Damping-off of cotton [*Pythium* spp., *Corticium solani*, and other fungi] was effectively combated in flats of Mississippi cotton soil by the treatment of machine-delinted seed at the rate of 3 oz. undiluted or 4 to 6 oz. 25 per cent. spergon in talc per bush. of seed.

Beasley (Elizabeth W.). **Effects of some chemically inert dusts upon the transpiration rate of yellow Coleus plants.**—*Plant Physiol.*, xvii, 1, pp. 101–108, 3 graphs, 1942.

In order to determine the effects of the chemically inert disinfectant dusts, Bancroft clay, fine and coarse talc, and silica, on the transpiration rate of plants, 90 potted *Coleus* plants, divided into four series, were treated with these preparations at the Texas Agricultural Experiment Station. The dusts were usually applied in the afternoon between 2 and 4 o'clock, and the weights of the plants were calculated morning and evening, before and after treatment, for a period of 10 to 14 days. Statistical analyses of the results indicated that normally the sole effect of the dusts is an increase in nocturnal water loss, and then only when the finer preparations (Bancroft clay and fine talc) are applied to the under, stomata-bearing leaf surfaces: the daytime transpiration rate was augmented only by Bancroft clay. The application of dusts to the upper surfaces produced no effect, and neither did treatments given at midnight, when the stomata are presumably closed. The loss of water through the agency of the dusts was chiefly significant among the younger and more tender plants, and it is considered unlikely that hardy field plants would suffer in this respect from the use of disinfectants of the type under observation.

Renn (C. E.). **Demonstration of Labyrinthula parasite in Eel-grass from the coast of California.**—*Science*, N.S., xcv, 2457, p. 122, 1942.

In a few areas of the Pacific Coast, marine eelgrass (*Zostera marina*) has of late undergone considerable wastage, and the author has recently demonstrated in specimens from North Humbolt Bay, California, and San Quentin Bay, Lower California, the presence of a species of *Labyrinthula* [*L.* (?) *macrocystis*] characterized by the same morphological features and unusual distribution in the newly invaded foliar tissue as that responsible for the depletion of the Atlantic eelgrass beds [and those of British Columbia: *R.A.M.*, xvii, p. 543; xix, p. 421].

Rayner (M. C[heveley]) & Levisohn (Ida). **The mycorrhizal habit in relation to forestry. IV. Studies on mycorrhizal response in Pinus and other conifers.**—*Forestry*, xv, pp. 1–36, 6 pl., 3 graphs, 1941.

In the second paper of this series of mycorrhizal studies [*R.A.M.*, xv, p. 737; xix, p. 36] an experiment was described in which three species of pine were submitted to soil treatments with different composts. The results now obtained show that in Wareham soil when direct inhibition of fungal activity is relieved, e.g., by compost action, mycorrhiza showing typical structure due to association with *Boletus bovinus*

become relatively numerous. Mycelium of this fungus is present throughout the area, and becomes active in mycorrhiza formation as the soil factors that inhibit fungal growth disappear. There is, therefore, small doubt that the poverty of mycorrhiza in untreated soil and the 'messy' or aberrant structure of most of them, are directly related to the action of these inhibiting factors. It must be assumed that the small amount of natural substratum accompanying the introduced mycelium suffices to maintain activity until the renewed vigour in root production and the ensuing mycorrhizal development bring about self-propagating soil changes advantageous to growth.

In other tests, control plots of *Pinus sylvestris* and *P. nigra* var. *calabrica* were inoculated with pure cultures of *B. bovinus* 14 months after sowing, with similar results to those in humus-inoculated plots. In both, individual seedlings or groups of seedlings of better colour and more vigorous growth appeared sporadically, the growth stimulus tending to spread thence throughout the plots.

The root systems of the seedlings in fungus-inoculated plots resemble those of plants in humus-inoculated soil, both differing strikingly from those of plants in control plots, in respect of colour, branching, abundance of mycorrhiza, and the comparative absence of aberrant structural features in individual mycorrhiza. Growth stimulus was slower in the pots inoculated with pure cultures.

If nutritional conditions for the seedling are directly associated with mycorrhizal activity, the observed impetus towards the production of root initials must precede stimulation due to this cause. Thus, the initial stimulus to root production and growth must be looked for in the surrounding soil. As it coincides with and radiates from points where inocula have been placed, it must originate in these inocula, and the conclusion follows that soil activities leading to the stimulation of plant growth are brought about by the introduction to seed-beds of suitable inocula, whether of soil, fragments of sporophore tissue, or pure cultures of specific mycorrhiza-formers.

Attempts to establish Sitka spruce [*Picea sitchensis*] from seed at Wareham having given unsatisfactory results, soil containing natural roots was obtained from Vancouver Island and Prince Rupert, on the Canadian mainland. Pot tests with Wareham soil were duplicated with a New Forest soil of similar origin but not infertile. Each set of experiments included three complete series, one receiving compost, the other two the same compost plus a 5 gm. inoculum of one or other Canadian soil. Controls were grown in each of the four soils, and other series included the addition of the same composts to the Canadian soils.

In the Wareham soil mycorrhiza of normal structure are absent, and most of the short roots were attacked by *Mycelium radicis atrovirens* and by a fungus resembling *Rhizoctonia sylvestris*. In the New Forest soil mycorrhiza of two kinds are formed as a result of association with *M. r. nigro-strigosum* and an unidentified Hymenomycete, but a high proportion of the rootlets were attacked by *M. r. atrovirens*. No *Rhizoctonia* attack was observed. In both Canadian soils mycorrhiza was formed by an unknown Hymenomycete, and in some cases by *M. r. nigro-strigosum*. The addition of compost in all cases produced marked stimulation of root and shoot growth, increased mycorrhizal activity, and reduction of fungal attack. Chlorosis occurred in the plants grown in Canadian soils or in soil inoculated with these soils, and this is ascribed to attack by two strains of *M. r. atrovirens* and a *R.* sp. resembling *R. sylvestris*, these fungi being imported in the soils from Canada. The need for caution in the empirical use of soil inocula for controlling mycorrhizal activities in seed-beds is thus emphasized.

A study of mycorrhizal response in Norway spruce (*Picea abies*), a species more refractory in Wareham soil than even Sitka spruce, was made in field plots and pot cultures receiving one of four different composts, or basic slag, or the same treatments with an added inoculum of Swedish soil at sowing: the results showed that there is an unidentified mycorrhiza-former for Norway spruce in the experimental area and it is suspected that *B. bovinus* may function in this way. Mycorrhiza formation is

completely inhibited in the untreated soil and comes into action slowly after treatment with composts or phosphatic manures. Absence of mycorrhiza is directly related to arrested growth and chlorosis in the experimental plants, and is believed to be a main cause of the similar behaviour of Norway spruce elsewhere in the area. The introduction of another mycorrhiza-former in soil from a Swedish stand facilitated mycorrhiza development and promoted growth in pot culture, but this beneficial effect was more than counterbalanced by the simultaneous introduction in the same soil of a strain of *M. r. atrovirens*, which was innocuous to the trees under native conditions, but deleterious in a new environment. Thus, further evidence is provided of the risk involved in the experimental use of soil or humus inocula in tree nurseries, if no attempt is made to define the conditions present in respect to mycorrhiza-formers or soil fungi known to be harmful to growth.

Investigation of the mycorrhizal equipment of Lawson's cypress (*Cupressus lawsoniana*), a native of the northern Pacific States of the American Union, showed that a fungus species able to form endotrophic mycorrhiza exactly resembling those found in this cypress in its native habitat is present in nursery soils in this country. It is not present in the soil of those parts of Wareham Forest where this tree has been sown or planted, and its appearance there was a legacy from the Oxford nursery where the trees were raised. Attention is drawn to the fact that a member of the vesicular-arbuscular group of mycorrhizal fungi [*Rhizophagus*: ibid., xviii, p. 470] capable of forming identical associations with roots of this tree is present in its native habitat and in British soil, and to the further fact that another member of the same group of fungi present in the mycorrhiza of *Molinia coerulea* throughout the Wareham area does not possess this ability. The observations made indicate that mycorrhizal association plays a critical part in the nutrition of this tree, and that the ability to form and maintain mycorrhiza is determined by soil conditions. The view that mycorrhizal association is a casual parasitism by certain soil fungi is completely at variance with these observations.

It is concluded that mycorrhizal association is a highly specialized aspect of the ecological balance normally maintained between the higher plants and their fungus competitors. Its real significance as an edaphic factor has been obscured hitherto.

De Turk (E. E.). **Plant nutrient deficiency symptoms. Physiological basis.**—*Industr. Engng Chem.*, xxxiii, 5, pp. 648–653, 2 figs., 1941.

The following conclusions were reached as a result of the author's observations in Illinois in conjunction with a study of the literature on plant nutrient deficiency. The most common cases of malnutrition are those of deficiencies of one or more essential elements, which may be interpreted as excesses of the non-deficient elements. Deficiencies are relative, i.e., an adequate supply of a given element under one set of conditions becomes insufficient as other elements accumulate. Deficiency may be due to an insufficiency of the element in the soil; insufficient solubility rate; physiological unavailability, as in the failure of acid-sensitive plants, such as red clover [*Trifolium pratense*], to absorb calcium at a low hydrogen-ion concentration; and physiological unavailability within the plant itself, expressed as failure to reduce absorbed nitrate preparatory to protein synthesis.

Nutrient deficiencies give rise to many kinds of symptoms, which may be roughly grouped as follows: inhibited growth, no specific symptoms; colour changes, usually foliar; tissue necrosis, mostly in the leaves; and malformation of different organs. The symptoms are produced indirectly, resulting from a series of unbalanced physiological processes. Thus, a given symptom may follow upon more than one original cause; the purpling of young maize foliage, for instance, may be primarily due to phosphorus or nitrogen starvation, a series of cold nights and warm, sunny days, or transverse creasing of the leaves. Temperature, humidity, and other environmental conditions may modify the expression of deficiency symptoms in such a way that the

same lack in a particular crop may produce diverse external features in different geographical regions. On account of the complicated relations prevailing between plant maladjustments and the corresponding symptoms, the latter should, for the time being, be regarded rather as aids to, than as actual methods of, diagnosis.

Hollaender (A.) & Emmons (C. W.). **Wavelength dependence of mutation production in the ultraviolet with special emphasis on fungi.**—*Cold Spr. Harb. Symp. quant. Biol.*, ix, pp. 179–186, 8 graphs, 1941.

Recent developments in the study of the biological effects of ultra-violet radiation on micro-organisms are surveyed with special reference to the authors' investigations on the mutations induced by this agency on *Trichophyton mentagrophytes* [*R.A.M.*, xix, p. 215], including a forthcoming paper on the process of recovery from irradiation effects.

Quintanilha (A.). **Étude génétique du phénomène de Buller.** [A genetic study of Buller's phenomenon.]—*Bol. Soc. broteriana*, Sér. 2a, xiii (*1938–1939*), pp. 425–486, 9 diags., [? 1939. Received March, 1942.]

This is an exhaustive critical discussion of 'Buller's phenomenon' (the diploidization of a haploid mycelium or structure by a diploid mycelium) [*R.A.M.*, xx, p. 589] in the light of genetic studies by the author and others on various representatives of the higher fungi.

Melhus (I. E.), Shepherd (D. R.), & Corkle (Marie A.). **Diseases of Potatoes in Iowa.**—*Proc. Iowa Acad. Sci.*, xlviii (*1941*), pp. 133–146, 2 graphs, 1941.

The area under potatoes, one of the first crops planted in Iowa, increased from 18,124 acres in 1855 to 170,285 in 1895, after which there was a gradual decrease until 1930, when only 44,666 acres were allocated to the crop. From 1865 to 1925 the tendency of the yields was gradually downwards and that of prices generally upwards.

Late blight (*Phytophthora infestans*) has been of frequent occurrence, but was destructive only in the years 1858, 1865, 1866, 1869, and 1876, though the losses ranged from 6 per cent. to heavy in 1885, 1886, 1903, 1915, 1918, and 1924 also. Common scab (*Actinomyces scabies*), first reported in 1870, caused losses ranging from 10 to 20 per cent. in 1919, 1932, and 1934, and during the past five years has been very virulent in the alkaline peat soils in the north of the State. Black scurf (*Corticium vagum*) [*C. solani*], first observed in 1905, has been very troublesome throughout the State since the severe outbreak in Mitchell County in 1918. Early blight (*Alternaria solani*) has been serious several times since 1892, and in 1912 caused 15 per cent. loss. The first record of black leg (*Bacillus atrosepticus*) [*Erwinia phytophthora*] dates from 1905, when a 25 per cent. reduction in three counties was reported; the disease did not recur until 1918, since when it has been present almost every year, causing exceptionally heavy damage on the Early Ohio variety in 1928. Ring rot (*Bacterium sepedonicum*) was first detected in the State in 1939. Since the first record of mosaic in 1918, the disease has been prevalent, especially on Green Mountain and Bliss Triumph, causing a 12 per cent. reduction in yield in 1935. Other viruses present in the State include spindle tuber, curly dwarf, leaf roll, witches' broom, and calico. Greenhouse indexing of tubers for the elimination of viruses from home-grown seed was found to be impracticable under Iowa conditions. *Fusarium coeruleum*, *F.* [*solani* var.] *eumartii*, and other *F.* spp. are responsible for dry rot of stored tubers. Silver scurf (*Spondylocladium atrovirens*), which is common, but of little importance, on potatoes held as seed stock, was first collected in the State in 1917.

Hilborn (M. T.) & Bonde (R.). **A new form of low-temperature injury in Potatoes.**—*Amer. Potato J.*, xix, 2, pp. 24–29, 1 fig., 1942.

'Internal mahogany browning' is the name proposed for a disorder of potato tubers, due to protracted exposure to a medium-low temperature (32° F.), which affected the Chippewa, Katahdin, and Irish Cobbler varieties in several commercial storage houses in Maine in 1938. In experiments carried out during 1938, 1939, and 1940 under controlled temperature and humidity conditions, Chippewas and Katahdins stored throughout the winter at 32° developed the reddish-brown discoloration by March, no corresponding symptoms being apparent in the same varieties kept at 38° or in Green Mountains at 32°. Leaf roll aggravated the injury in Chippewa tubers, accentuating a greenish fluorescence characteristic of the trouble and so closely simulating that associated with ring rot [*Bacterium sepedonicum*: *R.A.M.*, xx, p. 549] as to be indistinguishable from it but quite distinct from the bluish fluorescence induced by brief periods of exposure to lower temperatures (21° to 27°). The yield reduction in Chippewas and Katahdins from planting seed severely affected by internal mahogany browning in a test in 1940 amounted to 54 and 24 barrels per acre, respectively, the corresponding figures for seed showing slight to medium discoloration being 22 and 4, but the presence in a seed stock of a small proportion of slightly diseased tubers is unlikely appreciably to impair its planting value.

Karmarkar (D. V.) & Joshi (B. M.). **Investigations on the cold storage of Potatoes.**—*Misc. Bull. imp. Coun. agric. Res. India* 45, 22 pp., 1 pl., 3 graphs, 1941.

Cold storage studies on potatoes of the Garwhal, Kahbrar, Mombasa, Malta Red Skin, Scotch Up-to-Date, Dunbar Cavalier, Carter's Long Keeper, and Khed (Italian White Round) varieties, carried out at the Ganeshkind Fruit Experimental Station, Kirkee, between 1936 and 1939 demonstrated that at temperatures under 35° F. dormancy was indefinitely prolonged. At 40° maximum dormancy was nine months, and delay in placing the potatoes at this temperature after harvesting reduced the dormancy period. No wastage occurred at 40° or 35°, but black heart [*R.A.M.*, xx, p. 593] developed after three and five months at 30° and 32°, respectively. The development of this defect was associated with increased respiration after the latter period. Sprouting vigour remained unaffected when the dormant period was extended at 35° or 40°; in some cases the growth and yield obtained from seed stored for long periods at these temperatures were improved. Tubers suffering from black heart did not sprout on removal to a temperature of 68°, but merely rotted away. Tubers stored in a state of immaturity were attacked by *Penicillium*.

Kassanis (B.). **Transmission of Potato virus Y by Aphis rhamni (Boyer).**—*Ann. appl. Biol.*, xxix, 1, p. 95, 1942.

In glasshouse experiments, the aphid *Aphis rhamni* was found to be as efficient a vector of potato virus Y as *Myzus persicae* and to react to a preliminary starving period in the same way [*R.A.M.*, xx, p. 603]. In transmission tests from tobacco to tobacco (five insects used per plant) and from potato to potato (ten insects per plant), starved *A. rhamni* infected 22 out of 25 and 7 out of 10 plants, respectively (as compared with all plants infected by starved *M. persicae*), and unstarved *A. rhamni* infected 7 out of 20 and 3 out of 10 plants, respectively (compared with 7 out of 15 and none out of 5, respectively, infected by *M. persicae*).

Madarang (S. A.). **Rhizoctonia damping-off of Cinchona seedlings.**—*Philipp. J. For.*, iv, 2, pp. 105–121, 2 pl., 2 figs., 1941.

The fungus isolated from *Cinchona* seedlings affected by damping-off in the Bureau of Forestry plantation, Bukidnon, Philippines, agreed in morphological and cultural characters with *Corticium vagum* (*Rhizoctonia* [*C.*] *solani*) [*R.A.M.*, xviii, p. 578].

Soil inoculation experiments gave positive results on *Cinchona succirubra* and Benguet pine (*Pinus insularis*), but not on potato or tomato, indicating the possible implication of a physiologic race of the pathogen. Soil sterilization either by steam pressure or formalin, applied at a dosage of 2·5 l. per sq. ft. of soil to a depth of 3 to 4 in. before sowing the seeds, is an effective measure against the form of damping-off under observation.

D'Oliveira (B.). **New hosts for the aecidial stage of Uromyces graminis (Niessl) Diet.**—*Bol. Soc. broteriana*, Sér. 2a, xiii (*1938–1939*), pp. 81–92, 2 pl., [? 1939. Received March, 1942.]

A tabulated account is given of cross-inoculation experiments in 1935–6 with *Aecidium foeniculi* from *Foeniculum vulgare*, growing near Lisbon, on a number of cultivated cereals and wild grasses, of which only *Melica ciliata* proved to be susceptible. Teleutospores from this host, readily identifiable as those of *Uromyces graminis* [*R.A.M.*, xx, p. 136], gave rise to a profusion of sporidia, which were inoculated with positive results into 15 species belonging to twelve different genera of the Umbelliferae, including carrot (a highly susceptible host, developing severe necrosis), *Coriandrum sativum*, and parsley. *F. vulgare*, however, was the only plant harbouring the aecidial stage of the rust in nature: it is commonly found growing in close proximity to *M. ciliata*, on which heavy infection of the foliage and stems occurs in the early summer. These results are considered to establish the genetic connexion between *A. foeniculi* and *U. graminis*. Evidence is briefly adduced from artificial nectarization tests of the heterothallic character of *U. graminis*.

Lucas (G. B.). **Deterioration of the red rot fungus in culture.**—Abs. in *Proc. La Acad. Sci.*, vi, pp. 46–47, 1942.

Cultures of *Colletotrichum falcatum*, the agent of red rot of sugar-cane, having been observed to 'run out' through failure to sporulate on bean agar, experiments were conducted to determine whether such deterioration is due to the lack of some substance provided by the original substratum or to a natural decline in the reproductive capacity of the fungus. Single spores from a profusely fructifying culture were transferred by means of a micro-manipulator to agar drops in Van Tieghem cells, and on germination again removed to Petri dishes containing the selected medium (Richards's or oatmeal agar). When the mycelium thus obtained sporulated in its turn, one of the spores was picked up and the process of transference repeated. By this method *C. falcatum* has been grown for nine generations on Richards's and for seven on oatmeal agar with no loss of vitality. Similarly successful results were secured by the transference of hyphal tips [cf. below, p. 306], 200 to 300 μ long, from an abundantly fruiting culture, first to water agar in a Petri dish, and then to oatmeal agar, the process being repeated as soon as the mycelium arising from the tip began to produce spores.

It would appear from the outcome of these trials that *C. falcatum* is possessed of an inherent faculty for spore formation permitting of its culture for an indefinite period on a suitable medium.

Bell (A. F.). **Report of the Division of Entomology and Pathology.**—*Rep. Bur. Sug. Exp. Stas Qd, 1940–41*, pp. 19–23, 1941.

In this report on sugar-cane disease work in Queensland during the period under review [cf. *R.A.M.*, xx, p. 230], the author states that gumming disease (*Bacterium* [*Xanthomonas*] *vasculorum*) was present in the Moreton, Mulgrave, and Hambledon Mill areas. At Moreton, infection was confined to the susceptible H.Q. 285, which is no longer on the approved list. As a result of the rapid elimination of S.J.4, the general situation in the Mulgrave district has much improved. In the Hambledon area, the disease has continued to spread in S.J.4, and no marked improvement can be looked for until this variety is no longer grown. In this locality, the Pompey

variety is also widely cultivated, but its susceptibility makes its retention as an approved variety doubtful. In a resistance trial concluded on 8th October, 1940, Q. 28, 28–4291, 31–2484, 32–8560, Improved Fodder, and China showed no dead stalks and no oozing gum from the living stalks whereas H.Q. 426, 1900 seedling, H.Q. 458, and Pompey showed, respectively, 60 and 50 per cent., 10 and 30 per cent., 10 and 20 per cent., and 20 and 45 per cent., the corresponding percentages for D. 1135, Q. 29, and Q. 44 being 0 and 15, 0 and 4, and 0 and 2.

The chief sugar-cane disease in Queensland is still downy mildew (*Sclerospora sacchari*) [ibid., xx, p. 277], which occurred in the Cairns, Mackay, and Bundaberg areas. Owing to the vigilance of the Disease Control Boards [ibid., xxi, p. 44], the small outbreaks in the Cairns district were kept within bounds. Eradication orders were issued to two farmers in the Mulgrave and five in the Mossman area. In the Hambledon Mill area, only four affected stools were found on one farm. In the Mackay district, the position is improving as a result of the non-approval of P.O.J. 2878, the issue of eradication orders, and the activities of the Disease Control Boards.

Other work on this disease demonstrated that *Erianthus arundinaceum* exposed to heavy infection remained free from attack, whereas maize plantings made on 7th November all became diseased, stunted, and malformed within a month, though in a planting on 3rd October no sign of disease was observed until 5th December, when the plants were about 4 ft. 6 in. high. Later, two-fifths of the early plot became affected, but little malformation developed, and grain production remained normal. The later-sown plot, on the other hand, failed to produce any grain. Attempts at seed transmission were unsuccessful, as were efforts at direct infection of young leaves by enclosing them in tubes with affected leaves *in situ*. From 1st September until 15th October minimum daily temperatures ranged from 48·2° to 64° F., but only on five occasions did the figure exceed 60°, though the midnight temperature rose above 60° on 14 occasions. Sporulation was first noted on the morning of 16th October, following a temperature of 64° at midnight. After this, minima were always over 60°, and on one occasion the figure reached 68°. Sporulation was slightly irregular immediately after 15th October, but quickly became copious. These observations support others made in the laboratory which indicated that the minimum temperature for sporulation is about 60°. Oospores exposed in trash or soil, or treated with germination stimulants, failed to germinate. Further tests with warm-water treatment resulted in the production of healthy plants from diseased setts treated at 54° and 56° C. for 20 and 10 minutes, respectively, though germination after treatment was only fair. Treatment for 10 minutes at 54° appeared to be just on the border line of effectiveness.

Routine resistance trials carried out at Cairns showed that Q. 20, Q. 36, Q. 39, Q. 813 (standard), Atlas, Cato, Comus, Venus, S.C. 12/4, E.K. 28, Kassoer, *Saccharum spontaneum* Tank., *S. spontaneum* Burma, and *E. arundinaceum* were moderately resistant, while Neptune was highly susceptible. At Bundaberg, 28–4291, 31–2484, 32–8560, B. 726, Co. 281, P.O.J. 2725, Q. 28, Q. 43, Q. 45, G. 10, G. 48 (Mackay), H. 18 (Mackay), China, and Improved Fodder (Meringa) showed no infection; B. 2935, Co. 290, Glagah, Q. 813, 30 R. 115, 30 G. 1250, 29 G. 706, G. 34, H. 16, I. 6, I. 9, I. 11, I. 15, I. 27, I. 31, I. 35, I. 41, H. 45 (Mackay), and H. 63 (Mackay (showed 0 to 10 per cent. infection; P.O.J. 2878, Q. 25, and 30S.N.362 showed 10 to 20 per cent.; Marcus, P.O.J. 213, 31–1389, G. 16, I. 38, and I. 39 showed 20 to 40 per cent.; 32G. 1374, 33S.N. 1270, I. 25, I. 46, and I. 62 40 to 60 per cent.; and Co. 364 and I. 64 over 60 per cent. infection. The apparently high resistance of Glagah (three diseased shoots in a total of 537) indicates that the susceptibility of P.O.J. 2878 and other high-numbered P.O.J. canes does not derive from *S. spontaneum*. This view is confirmed by the behaviour of the two *S. spontaneum* canes in the Cairns trial.

Leaf scald (*Bacterium albilineans*) [ibid., xx, pp. 231, 291, 424] continued to be of economic importance only in the very wet area between Gardonvale and Babinda. In resistance trials, the canes are inspected at fixed intervals and the newly diseased

stools marked with a distinguishing peg, so that it can be ascertained at a glance when the symptoms became apparent. At the final examination, a note is taken of the diseased stools that appear to have recovered, so that the tolerance of each variety may be estimated. In a routine resistance trial in the very wet area mentioned Atlas, Badila, B. 726, B. 2935, C.P. 29/116, C.P. 807, Cato, Comus, D. 1135, H.Q. 409, H.Q. 426, Korpi, Marcus, Oramboo, Q. 20, Q. 25, and 31–1389 showed, respectively, 3, 39. 39, 4, 0, 0, 24, 6, 0, 31, 78, 50, 13, 33, 23, 3, and 14 per cent. diseased stools. Atlas, Badila, and Oramboo were tolerant, H.Q. 426 fairly so, and Cato, H.Q. 409, and Korpi recovered. H.Q. 426 was the most adversely affected.

The position with regard to Fiji disease [ibid., xx, p. 230] improved in the Bundaberg area, and infection remained at its previous low level at Isis. Strict control of varieties and systematic inspections by the local Cane Disease Control Board have assisted in reducing infection in the Maryborough district, and a partial return to the cultivation of susceptible varieties should soon be practicable in this area. The improved situation in the Logan district has permitted the approval of P.O.J. 2878. In a varietal resistance trial, though infection was too light to allow specific conclusions, Q. 25 was even more susceptible than P.O.J. 2878, while Q. 27 appeared to be quite resistant.

To ascertain whether exposure of cane setts to the sun would control chlorotic streak [ibid., xx, p. 231], setts of Badila on a sheet of galvanized iron were exposed to direct sunlight for six hours. The internal sett temperature ranged from 43° to 47° C. for the different setts. After exposure, the setts, together with the unexposed controls, were soaked overnight and planted. Six months later, only 20 per cent. of the stools from the exposed setts were affected, as against 90 per cent. for the controls, the former also appearing much the more vigorous.

Drought during the spring of 1940 was succeeded by a very long wet season during which normal weed eradication was impracticable. Large populations of *Aphis maidis* resulted in the spread of mosaic being more rapid than usual, especially in the Bundaberg area, where Q. 25 became infected. It is expected that the position will right itself when conditions again become normal.

MUNDKUR (B. B.). **Notes on Saccharum and Erianthus smuts.**—*Kew Bull.*, *1941*, 3, pp. 209–217, 1942.

In a critical study of 18 species of the ovariicolous smuts on species of *Saccharum* and *Erianthus* [cf. *R.A.M.*, xix, p. 237] the author found that *Ustilago pulverulenta* belongs to the genus *Cintractia*, and the name proposed by Cooke and Massee, *C. pulverulenta*, is retained after examination of the type specimen. The host was redetermined by N. L. Bor as a species of *Saccharum*. The smuts determined by Sydow as *C. pulverulenta* and by Boedijn as *U. pulverulenta* are *U. courtoisi* Ciferri. *U. erianthi* Sydow is transferred to the genus *Sphacelotheca*. *Sorosporium indicum* n. sp. is described on *Saccharum munja*. Examination of type material of both *Ustilago sacchari* Rabenh. and *U. sacchari-ciliaris* Bref. showed these species to be identical, the correct name for the fungus being *Sphacelotheca sacchari* (Rabenh.) Ciferri. A smut on *E. capensis* from South Africa is thought to be an undescribed species of *Tilletia* but insufficient material was available to enable a final decision to be reached. A revised description is given of *U. microthelis* Syd. based on a study of type material of this Brazilian species on *E. asper*; the spores measured 7·9 to 12·6 (mean 10·5) μ. All species mentioned occur in India except the two last-named.

RYKER (T. C.). **Loss of sporulation in Cercospora.**—Abs. in *Phytopathology*, xxxii, 1, p. 16, 1942.

Cultures of certain species of *Cercospora*, originating either in the host tissues or from single spores, have been observed ultimately to produce feebly sporulating

mycelial variants, usually white and devoid of conidia, which overrun the substratum. It is, however, possible to maintain the original type by transference from hyphal tips or conidia. The white variant, which remains fixed, has been found, from a study of 38 single hyphal-tip isolates of germinating conidia, to appear in *C. oryzae*, *C. beticola*, *C. apii*, and *C. nicotianae*. Since the conidial cells are uninucleate, the variants are presumed to be mutations. The loss of sporulation in cultures of the species of *Cercospora* under observation is ordinarily due to the suppression of the original cultures by non-conidial variants.

SNYDER (W. C.) & HANSEN (H. N.). **The importance of variation in the taxonomy of fungi.**—*Proc. sixth Pacif. Sci. Congr.*, iv, pp. 749–752 [? 1940].

In discussing the importance of natural variation in the taxonomy of fungi the authors distinguish between polymorphic, cyclogenic, Mendelian, temporary, and apparent variations, and mutations. The first includes all distinct morphologic phases of development that a fungus may exhibit in nature, under the proper conditions. An example occurs in *Leptosphaeria pratensis* [*R.A.M.*, xviii, p. 320]. One morphologic stage is *Stagonospora*, another *Phoma*, and these imperfect stages have been variously described as *Ascochyta*, *Septoria*, *Marssonia*, *Diplodina*, *Phleospora*, etc., and as different species in these genera. Cyclogenic variation is a particular type of polymorphic variation, in which the stages follow one another in a definite succession. This type is seen in the rusts, e.g., *Puccinia graminis*. The significance of Mendelian or inherent variation in taxonomy is well illustrated in the rusts, notably in *P. graminis*, and in the smuts, where it occurs in a number of morphological types and a wide range of physiologic races; further, Mendelian segregants from imperfect stages of fungi with undiscovered sexual stages in nature are often wrongly described as distinct fungi. Temporary variations include profound differences in taxonomic features, and a good example has recently been described [ibid., xviii, p. 609]. Apparent variations include those resulting from impure culture, those caused by disease, and those due to heterocaryotic mixtures or combinations of closely related forms. Mutation variations may differ widely from the parent, and constitute a real problem.

To serve its purpose, a taxonomic scheme must be based on (1) a knowledge of the range of variability of each fungus treated, morphologically, and, where important, physiologically; (2) a knowledge of the morphological characters common to all the variants, upon which to formulate the morphological species limits; (3) a knowledge of the biological characteristics of the species or the individuals comprising it; and (4) a standardized technique enabling any worker anywhere to achieve the proper determination of his species with a minimum of effort and a maximum of accuracy.

SYDOW [H.]. **Mycotheca germanica Fasc. lxv–lxviii (No. 3201–3400.)**—*Ann. mycol., Berl.*, xxxviii, 5–6, pp. 453–484, 1940.

Included in this critically annotated list of exsiccata of fungi published by the author in periodical instalments may be mentioned, in addition to a new genus *Chondrostroma*, with its type species, *C. laricis*, on larch (*Larix sibirica*) near Siegen [Westphalia] and four other new species, *Puccinia pumilae-coronata* H. Paul, with its aecidial stage on *Rhamnus pumila* in the Bavarian Alps; *P. sesleriae* Reich., with its aecidial stage on *R. saxatilis* in the neighbourhood of Vienna; *Mycosphaerella microsora* n. sp., the perfect stage of *Cercospora microsora*, on dead lime (*Tilia parvifolia*) leaves; and a *Septoria* on wheat assigned by R. Sprague to a morphological variety of *S. nodorum* characterized by multiseptate spores besides the ordinary uni- to triseptate ones, the average dimensions of the (?) German material being 20 to 35 by 2·5 to 3·5 μ compared with 16 to 32 by 2·2 to 3·5 μ for North American specimens.

Sheffield (F[rances] M. L.). **Presence of virus in the primordial meristem.**—*Ann. appl. Biol.*, xxix, 1, pp. 16–17, 1942.

The fact that no intracellular inclusions have ever been found in the primordial meristem of virus-infected plants led the author to test experimentally whether viruses are capable of penetrating into the growing point. Water suspensions of meristematic tissue dissected from apices of shoots and roots of tobacco plants infected with tobacco mosaic and tomato plants infected with tobacco mosaic or aucuba mosaic viruses produced lesions in each case when inoculated into *Nicotiana glutinosa* leaves. These results are taken to indicate that virus is present in the primordial meristem and it is concluded that the absence of intracellular inclusions must be attributed to some other causes. Similar tests with apical meristems from roots and shoots of tomato plants infected with severe etch virus gave negative results, but the failure is believed to be due to the fact that the inoculum was too dilute (the virus content of sap from plants infected with severe etch is only about one-thousandth of that from tobacco plants with mosaic) rather than to the absence of virus in the tissue.

Wynd (F. L.). **Certain enzymatic activities of normal and mosaic infected Tobacco plants.**—*J. gen. Physiol.*, xxv, 4, pp. 649–661, 3 graphs, 1942.

At the University of Illinois, Urbana, the writer inoculated five-leaved Burley tobacco plants in the lowest leaf remaining after the removal of the two basal leaves with the virus of tobacco mosaic, expressed from severely diseased foliage, and followed the activities of oxygenase, peroxidase, catalase, and invertase in infected and normal leaves of comparable age at two- to three-day intervals over a period of three weeks. The inoculated leaves exhibited a great decrease relative to normal tissue in the activity of oxygenase and peroxidase on the sixth day, followed by an abrupt rise from the 14th to the 18th, and then by another decline. The increased activity of catalase reached a maximum about the eighth day, with a secondary peak on the 16th to 18th. Invertase sank to a minimum, compared with normal plants, about the eighth day, and again on the 16th to 18th.

Frampton (V. L.). **On the size and shape of the Tobacco mosaic virus protein particle.**—*Science*, N.S., xcv, 2461, pp. 232–233, 1 graph, 1942.

The author, discussing recent studies on the shape and size of the tobacco mosaic virus protein particle, points out that Stanley and his co-workers seem to regard aggregation as of little significance. They hold that conclusions reached as to the size and shape of the protein particles from ultracentrifuge and viscosity studies are valid and accurate; they cite electron microscope photographs as substantiating evidence, and from them conclude that the length of the protein molecule is 280 mμ [*R.A.M.*, xx, p. 428], though the photographs show many particles which are much shorter than this. Measurements from photographs are not very accurate; it is impossible to be sure, for instance, that all the particles are lying flat. A length distribution curve for 159 particles in photographs published by Stanley and Anderson indicates length classes of 300, 190, 150, 100, and 37 mμ, essentially in the ratio of 8 : 5 : 4 : 3 : 1, which clearly implies orderliness. When Melcher and his co-workers found in their photographs particles the lengths of which were predominantly in the neighbourhood of 140 and 190 mμ, Stanley and Anderson concluded that they were photographs of different strains of the virus [loc. cit.], but the same lengths occur in the photographs published by Stanley and Anderson [loc. cit.]. It is also pointed out that the size of the suggested basic unit agrees well with the diameter of some 38 mμ, arrived at by Thornberry from ultrafiltration experiments [ibid., xiv, p. 721].

Valleau (W. D.) **Breeding Tobacco for resistance to mosaic.**—Abs. in *J. Bact.*, xliii, 2, p. 272, 1942.

Two types of resistance to mosaic have been utilized in the breeding of Burley

tobacco [*R.A.M.*, xxi, p. 227], one, occurring in the Ambalema variety, apparently representing true resistance. This type is governed by at least two recessive Mendelian factor pairs, and the use of successive resistant selections for back-crossing with Burley has produced strains of the latter combining good quality with a high degree of resistance. The other type of resistance, derived from *Nicotiana glutinosa*, is characterized by a localization of the virus in the necrotic spots formed at its sites of entrance. The back-crossing of a fertile hybrid between *N. glutinosa* and *N. tabacum*, followed by back-crossing with Burley or successive resistant selections, resulted in the isolation of several homozygous resistant strains of Burley closely resembling but not identical with the Burley parent. Apparently a group of genes of *N. glutinosa*, besides the necrotic spotting factor, are retained in these hybrids after five consecutive back-crosses. Strains of Burley have also been developed carrying both types of resistance.

Allington (W. B.) & Johnson (J.). **The relation of potassium to water-soaking of Tobacco.**—Abs. in *Phytopathology*, xxxii, 1, p. 1, 1942.

Further investigations were made at the Wisconsin Agricultural Experiment Station on the physiological water-soaking of tobacco plants in relation to wildfire (*Bacterium tabacum*) [*Pseudomonas tabaci*] and blackfire [angular leaf spot] (*Bact. angulatum*) [*P. angulata*: *R.A.M.*, xix, p. 124]. It was shown that incipient or actual potassium deficiency enhanced susceptibility to the disturbance, which on the other hand scarcely affected plants with ample reserves of the mineral, except under conditions of high relative humidity and low light intensity. The liability to water-soaking of potassium-deficient plants is accompanied by susceptibility to bacterial infection. A shortage of potassium in the foliar tissue is known to induce extensive cellular necrosis, which may account for the special prevalence of water-soaking in the living areas surrounding such foci.

Diachun (S.), Valleau (W. D.), & Johnson (E. M.). **Isolation of Bacterium angulatum from overwintered Tobacco field soil.**—Abs. in *Phytopathology*, xxxii, 1, pp. 2–3, 1942.

To ascertain whether *Bacterium angulatum* [*Pseudomonas angulata*] is present in the overwintered soil of tobacco fields [in Kentucky], samples of such soil were mixed with sterile water and poured over the lower surface of susceptible tobacco leaves. The leaves were artificially water-soaked [see preceding abstract] by means of a strong jet of water from a hypodermic syringe just before inoculation in order to promote the ingress of the bacteria present on the leaf through the stomata. Between 2nd November, 1940, and 18th April, 1941, *P. angulata* was recovered from field soil in which naturally infected tobacco had grown during the previous summer, being isolated from 37 out of 182 samples on nine out of 15 dates.

Morgan (W. L.) & Hely (P. C.). **Combined sprays for late Tomatoes.**—*J. Aust. Inst. agric. Sci.*, vii, 4, pp. 158–161, 1941.

In a test conducted at Mangrove Mountain, New South Wales, Pritchard tomatoes were sprayed nine times between 18th February and 24th April, 1941, as follows: (a) Bordeaux mixture (1–1–20) plus nicotine sulphate (1 in 400), (b) Bordeaux mixture (1–1–20), (c) copper oxychloride (1 lb. in 40 gals.) plus nicotine sulphate, (d) as (c) plus hydrated lime (1 lb. in 40 gals.), (e) Bordeaux mixture (1–1–40) plus nicotine sulphate, and (f) Bordeaux mixture (1–1–10) plus nicotine sulphate. The nicotine sulphate and hydrated lime were used only on two occasions, and lead arsenate was included in all the sprays.

The plants sprayed with (a) gave larger yields than any others, both in total weight of marketable fruit and in total number of fruits harvested. The yield of marketable fruit in pounds was significantly greater in this treatment than in (b) or (f). The

difference between (e) and (a) was substantial, amounting to 11 per cent. Significantly smaller numbers of fruit were harvested after treatment with (a) and (b) than with (e) and there was no significant difference in yield of marketable fruit or total numbers of fruits harvested between the copper oxychloride plots (c and d) and the (e) plots. The lowest yield of marketable fruit and the smallest total number of fruits harvested came from the plots treated with (f). The smaller numbers of fruits and the low yield from the strong Bordeaux plots are attributed almost entirely to the destruction of blossom buds, flowers, and young fruits by the spray.

The percentage of marketable fruits was significantly less in the copper oxychloride plots than in any of those treated with Bordeaux mixture, largely owing to heavier infection with early blight (*Alternaria solani*) on the fruits sprayed with copper oxychloride. There was no significant difference in the percentage of marketable fruit between the weak and strong Bordeaux mixtures.

The amount of early blight on the fruit at harvesting was significantly least in the plots sprayed with Bordeaux mixture (1–1–10). It was significantly lower where Bordeaux mixture (1–1–20) was used without nicotine sulphate than where Bordeaux mixture (1–1–40) or the copper oxychlorides were used. However, the plants sprayed with Bordeaux mixture (1–1–40) did not show significantly more early blight on the fruits than those sprayed with Bordeaux mixture (1–1–20) plus nicotine sulphate. All the plots sprayed with Bordeaux mixture were significantly freer of early blight than the two copper oxychloride treatments.

R. D. Wilson reported that the various strengths of Bordeaux mixture and copper oxychloride were all of some value in controlling foliage infection by early blight, though in no instance was control complete. In this respect, copper oxychloride was the least effective treatment. No appreciable injury was caused by copper oxychloride and Bordeaux mixture (1–1–40), but the two higher concentrations of Bordeaux mixture were injurious. Taking into account both spray injury and early blight control the best results were given by the Bordeaux mixture (1–1–40).

Prevention of spotted or bronze wilt of Tomatoes.—*Agric. Gaz. N.S.W.*, liii, 1, p. 32, 1942.

Promising results in the control of tomato spotted wilt are being obtained at Hawkesbury Agricultural College by spraying the plants from the very early seed-bed stage onwards with a solution of 2 oz. tartar emetic and 4 oz. sugar in 4 gals. water [*R.A.M.*, xx, p. 282], which acts as a poison bait for insect vectors. In the unsprayed plots over three times as many affected plants were found (by the second week of picking) as in the plots sprayed twice a week, and over 2½ times as many as in those sprayed once a week. For seed-bed use, growers are recommended to prepare a stock solution of 1 oz. tartar emetic in 1 qt. water. To 4 fluid oz. of the stock solution water is added to make up to 32 oz., together with a teaspoonful of sugar. The spray may be conveniently applied to seedlings or small plots of tomatoes by means of a 'fly sprayer'. A fine mist is required, and for reasons of economy the nozzles of spray pumps should be reduced in size for field applications.

Haynes (W. C.). **Mold count as an index to quality of Tomato juice.**—*Canning Age*, xxii, 9, pp. 438–439, 458, 1 fig., 1941.

Attention is drawn to the advisability of the employment of an experienced analyst in New York State tomato-canning plants, thereby preventing heavy losses through the Federal and State embargo on mould-contaminated produce. The expense of such employment is stated to be negligible in comparison with the reduction of profits entailed in the confiscation of even a single shipment. For the benefit of students brief notes on the technique of examination are included.

Hester (J. B.). **Boron and manganese in Tomato production.**—*Amer. Fertil.*, xcv, 7, pp. 5–8, 24, 26, 4 figs., 1941.

Symptoms of boron deficiency in tomatoes have been observed by the writer in various parts of the United States and Canada. Tests carried out by a special technique, using sunflower as an indicator plant, on 839 soil samples from New Jersey and eastern Pennsylvania revealed varying degrees of insufficiency of this element in 18 per cent. of the samples, notably the lighter types with an acid reaction. Field experiments on the practical application of these data to the control of the deficiency symptoms in tomatoes are in progress, pending the conclusion of which the addition of 5 lb. borax to each ton of fertilizer is recommended.

Manganese deficiency has been found to lead to a low vitamin C content of tomatoes.

Hepting (G. H.). **Reducing losses from tree diseases in eastern forests and farm woodlands.**—*Fmrs' Bull. U.S. Dep. Agric.* 1887, 22 pp., 9 figs., 1942.

In this bulletin the author has brought together the chief items of information on tree diseases significant in the eastern and southern parts of the United States [cf. *R.A.M.*, xviii, p. 827]. Decay, pruning, cankers, leaf diseases, epidemic killing diseases, and the deterioration of logs and lumber are discussed from the standpoint of the small landowner, suggestions being given for control where feasible. Most of the points dealt with have already been noticed [ibid., xviii, pp. 280, 827, *et passim*].

Harris (M. R.). **The behavior of Endothia parasitica on Chestnut trees in California** —Abs. in *Phytopathology*, xxxii, 1, p. 7, 1942.

Three chestnut groves in San Joaquin County, California, have been found infected by *Endothia parasitica*, the observed presence of which dates in one case from 1938 and in the two others from 1934. The origin of the fungus is not known, but it is believed to have been introduced on scions from the eastern States. The blight lesions are most prevalent at or below soil-level. The perfect stage of the organism has not yet been detected locally, but pycnidiospores, carried by irrigation water, have been shown to be largely responsible for the spread of infection, while contaminated pruning tools are occasionally implicated. Promising indications of the ultimate eradication of the parasite have been obtained by inspection, twice a year, of the affected groves and destruction of diseased trees.

Miller (P. W.). **Current investigations on the control of Filbert and Walnut blight.**—*Rep. Ore. St. hort. Soc., 1941*, pp. 120–123, 1942.

In further spraying tests against filbert [*Corylus avellana*] blight (*Phytomonas corylina*) [*R.A.M.*, xx, p. 40] in Oregon, bud and twig infection was reduced from 15·2 to 1·4 per cent. in a 12-year-old Barcelona filbert orchard by one application of Bordeaux mixture (8–4–100) plus Grasselli spreader-sticker (1 oz. per 100 gals.). In another orchard, three applications of Bordeaux mixture (8–4–100) in late summer, late autumn, and early spring reduced bud and twig infection from 16·3 to 1·9 per cent., a single application in late summer reducing it to 3·1 per cent.

In normal seasons one application of Bordeaux mixture (8–4–100) plus a wetting agent applied in late summer before the first rain falls will hold the disease in check. When the autumn and winter are exceptionally wet a further application in late autumn (when the leaves are about three-fourths off the trees) and another in early spring (when the leaf buds begin to open) may be necessary.

Tests against walnut blight [*Xanthomonas juglandis*: ibid., xx, p. 237], which during 1941 reached epidemic proportions in Oregon, showed that both copper oxalate and yellow cuprous oxide were highly efficacious and caused little if any foliage injury. In one orchard, 20 per cent. copper oxalate (3–100), yellow cuprous oxide (2–100), and

Bordeaux mixture (6–2–100), applied in the early, middle and late pre-bloom, and early post-bloom stages reduced infection from 53·7 to 2·9, 2, and 1·7 per cent., respectively. Small-scale tests can now be made by growers who desire to do so with yellow cuprous oxide; it should be used at the rate of 2 lb. per 100 gals. water, with a good adhesive.

In another test, infection was reduced from 53·7 to 4·3 per cent. by four applications of a dust composed of 10 per cent. yellow cuprous oxide, 15 per cent. micro-sulphur, 65 per cent. soapstone, and 10 per cent. diatomaceous earth. This control was approximately as good as that given by an equal number of applications of Bordeaux mixture (6–2–100), which reduced infection to 3·2 per cent.

Miller (P. W.). **A report of progress and studies of the causes of the decline and death of Walnuts in Oregon.**—*Rep. Ore. St. hort. Soc., 1941*, pp. 124–126, 1 fig., 1942.

Investigations to date on the causes of the decline shown in recent years by many walnut orchards in Oregon indicate that the widely distributed mushroom root rot due to *Armillaria mellea* is of comparatively small importance, only 25 cases having been found in 10 years. Other possible parasitic agencies of decline (studies on which are in progress) include *Rhizoctonia* sp., *Verticillium* sp., *Fusarium* sp., *Ramularia* sp., *Pachybasium* sp., *Cadophora* sp., *Gloeosporium* sp., and *Chaetomium* sp., which have been isolated from dead roots and diseased crowns, but which, in limited tests, have not so far been found pathogenic.

Among the more important non-parasitic factors apparently operative are 'black line' or 'girdle' [*R.A.M.*, xix, p. 309], winter injury, shallow soil, drought, inadequate drainage, close planting, and combinations of these factors. Black line is a widely distributed disorder of Franquette walnuts grafted on Californian black walnut rootstocks or hybrids of other species with this one. Some 75 per cent. of the dead and dying trees found in grafted Franquette orchards show this trouble. Losses from winter injury have been negligible in the last five years. Most of the declining orchards are situated on shallow soils, in upland areas liable to drought. Poor drainage is a factor of considerable importance in Oregon, decreasing the vigour of the trees and rendering them subject to damage from winter injury, shot-hole borers, and other agencies; walnuts will not thrive on water-soaked soils or those with a high water table. Close planting chiefly affects the older orchards, where the trees as a rule are not more than 45 ft. apart.

Findlay (W. P. K.). **The prevention of decay in Beech.**—*Wood, Lond.*, vii, 2, pp. 37–38, 2 figs., 1942.

In order to prevent the development in felled beech logs of fungal decay, mainly caused by *Stereum purpureum*, which may penetrate from 4 to 5 ft. from the ends during the spring and summer, representing a loss of upwards of 20 per cent. of the timber, the writer advocates the regulation of the rate of felling in such a way as not to leave the wood lying for more than a very few weeks in the summer months. Where special conditions preclude immediate attention to the felled logs, the prompt application to the butt and top ends of a waterproof coating, such as hardened gloss oil or melanoid, will reduce the drying rate and thereby largely counteract splitting and the subsequent ingress through the cracks of 'dote'-producing organisms. Creosote may be substituted for the waterproof coating in the case of less valuable timber.

Cartwright (K. St. G.). **The variability in resistance to decay of the heartwood of home grown Western Red Cedar (Thuja plicata D. Don.) and its relation to position in the log.**—*Forestry*, xv, pp. 65–75, 2 figs., 2 graphs, 1941.

To determine whether the degree of resistance to fungal attack of the wood of *Thuja plicata* grown in England varies at different heights of the trunk and whether this variation is associated with concentration of water-soluble extractive, a tree

80 ft. tall and about 65 years old was cut down, and test samples were cut from the 30 ft. clear bole every 5 ft. along its length, representing the timber from varying points on the diameter, excluding the pith, at these heights. The samples were then inoculated with *Polystictus versicolor* and *Poria incrassata*, using a modified form of the wood-block method in which the fungi were cultivated on sawdust with an added accelerator. The samples were exposed to infection for a period of six months.

The results demonstrated that the resistance of English-grown western red cedar to white and brown rot is of the same order as that of imported timber. The heartwood from the base showed little variation across the trunk in point of resistance, the wood in this part being very resistant. There was, however, some evidence that the outer wood was more resistant to *Polystictus versicolor* than that next to the pith. The difference in resistance to both rots between the outer and inner heartwood of each section became increasingly apparent with increasing height, the newest heartwood being the most resistant. In each case, resistance declined as the centre of the tree was approached. The total average resistance across the trunk was greatest at the base, and progressively decreased up the tree.

The amount of material soluble in hot water was determined in samples from different positions in the trunk, and the toxicity of these extracts to *Fomes annosus* was determined. In each cross-section examined, the amount of material extracted by hot water was greater in the outer heartwood adjoining the sapwood than in the central heartwood, the toxicity of the extracts being correspondingly higher. Resistance therefore appeared to be closely correlated with amount of extractable substances present in the samples. Serious decay was found only in wood containing under 5 per cent. by weight of hot water extractives. Samples of Canadian-grown material analysed for extractives contained about 6·9 per cent., a figure exceeded by samples from the outer heartwood near the base of the English tree. The P_H values of the Canadian and home-grown material were 2·2 and about 4·5, respectively.

It would appear that, in general, wood from butt planks of heartwood will be most resistant to infection, whether taken from the outer part or near the centre, but higher up, planks from the outer heartwood will be more resistant than those from the centre.

Widder (F.). **Untersuchungen über forstschädliche Cronartium-Arten.** [Studies on silviculturally injurious species of *Cronartium*.]—*Öst. bot. Z.*, cx, 2, pp. 107–117, 1941. [Abs. in *Biol. Abstr.*, xvi, 2, p. 460, 1942.]

The author's critical studies on the nomenclature of *Cronartium asclepiadeum*, *C. gentianeum*, and *Peridermium pini* [on pine: *R.A.M.*, xviii, p. 644] lead him to the acceptance of these names, while *P. truncicola* is retained as a collective name for the aecidia of all three species. The geographical distribution of *C. gentianeum* is outlined.

Neilson-Jones (W.). **Fused needle disease of Pines.**—*Emp. For. J.*, xx, 2, pp. 151–161, 2 pl., 1941.

After noting the occurrence of needle fusion [*R.A.M.*, xx, p. 340] on Corsican pine [*Pinus nigra* var. *poiretiana*], mountain pine [*P. mugo*] and Scots pine [*P. sylvestris*] (none of which is listed as susceptible by Young [cf. ibid., xix, p. 682]) in the vicinity of Wareham, Dorset, during 1941, and recording it as affecting *P. contorta* in Wales, *P. mugo* in Yorkshire, and *P. halepensis* in Arizona, the author describes and discusses experimental data obtained by him on this disease. Observations on trees in pot culture showed that severely affected *P. contorta* plants if potted in Wareham soil retained their characters for some years, but gradually recovered as the soil improved; recovery was invariably associated with the development of short roots and mycorrhiza. When such plants were potted in good woodland soil (e.g., from the New Forest) or in Wareham soil plus compost, they recovered the following year. Recovery was

similarly rapid when plants potted in Wareham soil received drainage water which had percolated through good woodland soil. Such treatment, like the addition of compost, removed the inhibitory effect of Wareham soil on fungal growth and permitted mycorrhizal development. The addition of 10 per cent. cellulose to Wareham soil in pot tests slightly depressed shoot growth and needle length, and reduced the growth of plants in New Forest soil to the level of plants grown in Wareham soil. Root examination showed that the addition of cellulose profoundly disturbed the formation of the normal mycorrhiza freely produced in New Forest soil, while in Wareham soil mycorrhizal production, in the absence of ameliorative treatments, is always poor. The needles of experimental plants grown in Wareham soil with or without cellulose were short, while those of plants in New Forest soil plus cellulose were much shorter than those of plants in New Forest soil alone, but less reduced than in plants in Wareham soil. In most of the plants in New Forest soil plus cellulose some needles developed hooks, suggesting incipient needle fusion.

In conjunction with the results of root examination, these data suggest that recovery from needle fusion occurs as soon as conditions are provided that favour short root production and the establishment of a normal mycorrhizal system. They also indicate that the incidence of the disease is associated with the arrest of short root development and of mycorrhiza formation, rather than with consistent mycorrhiza poverty.

Grafting experiments between healthy and affected trees gave negative results, entirely supporting Young's conclusion that the condition is not attributable to a virus. When small blocks of *P. contorta* in a stand with a high incidence of needle fusion were treated with solutions of zinc and boron by spraying the trees and dressing the ground, no effect whatever had become perceptible after three years. Experimental work by Dr. Rayner [cf. ibid., xix, p. 36] strongly supported Young's view that a correlation exists between the development of needle fusion and the phosphorus content of the substrate. In this connexion, it is pointed out that all the extensive plantings of *P. contorta* in which widespread needle fusion developed, and those of Corsican and mountain pine in which sporadic cases occurred, received no soil treatment but ploughing, the effect of which is to dilute the small amount of phosphorus present in the top few inches.

The author does not accept Young's carbohydrate hypothesis [ibid., xix, p. 683], but ascribes the development of needle fusion to a sudden shortage of water in the plant as the leaves start to expand, the deficiency arising from reduced root absorption owing to failure of the root system to provide functional short roots and mycorrhiza at this critical juncture.

Thomas (W. D.). **A survey of northern Colorado flora bearing mycorrhizae.**—*J. Colo.-Wyo. Acad. Sci.*, iii, 1, pp. 37–38, 1941. [Abs. in *For. Abstr.*, iii, 4, p. 283, 1942.]

Common species of Salicaceae, Fagaceae, Ulmaceae, and Betulaceae in northern Colorado bear only ectotrophic mycorrhiza; some of the Oleaceae are associated exclusively with ectendotrophic mycorrhiza; while members of the Pinaceae and Rosaceae harbour both forms. A list is given of 21 families, in some of which the mycorrhizal relationships are endotrophic.

Bailey (H. E.). **The biology of Polyporus basilaris.**—*Bull. Torrey bot. Cl.*, lxviii, 2, pp. 112–120, 4 figs., 1941.

For many years past, *Cupressus macrocarpa*, extensively planted in California as an ornamental, has been affected by a brown pocket rot caused by *Polyporus basilaris* n. sp. A field study showed that only 2 per cent. of the trees examined had become infected by the age of 26 years, while in another stand 88 per cent. were infected at an average age of 65 years. Rotting was confined to the bole, though very occasionally present in the branches and roots. In the early stages, the trunk frequently shows

only a single pencil of rot, extending for a distance of from a few inches to 2 ft.; the infected wood appears almost normal, but is usually tinged with yellow. When the infected pockets dry out, they darken and show fine checks. In severely decayed trees, one or more pencils of rot may occur on the advancing line of decay, which spreads by long finger-like protrusions into the heartwood. The rot gradually becomes very complete, and leaves a brown, crumbly residue, which cracks into squares or rectangular blocks. In advanced stages, the pockets coalesce, forming masses of rot with thin, irregular strips of firm wood scattered through the mass. White mycelial wefts often appear in the cracks, but there is no apparent discoloration in the wood beyond the sharp border of the pockets. Active mycelium was found only in a narrow margin round the pocket of rot.

The sporophores are described as annual or reviving with only marginal growth, frequently poorly developed and nodulose in furrows on the trunk, imbricate where well-developed, tough and leathery when fresh, rigid and hard on drying. The applanate or somewhat convex, dirty greyish pileus measures 1 to 4 by 2·5 to 6 by 0·4 to 0·8 cm., and becomes greyish-brown or blackish on drying; the pore surface is white when fresh, unchanged in drying, or becoming isabelline or dirty buff, the tubes 1 to 3 mm. long, the mouths circular, then subangular to irregular, thick-walled, entire, averaging 3 to 4 per mm. The ellipsoid or narrow-ellipsoid, smooth, hyaline spores measure 4 to 5 by 2·5 to 3·5 μ. No cystidia were observed.

In culture, mycelial growth was slow. Only a thin, thread-like reticulum of interwoven hyphae covered the surface of the wood block (*C. macrocarpa*) in a sparse, white growth, but analyses on wood samples from blocks which had lost 10·2, 18·1, and 39 per cent. weight during decay showed that the fungus had progressively utilized many of the components of the wood.

Hirt (R. R.) & Hopp (H.). **Relation of tube layers to age in sporophores of Fomes igniarius on Aspen.**—*Phytopathology*, xxxii, 2, pp. 176–178, 1 fig., 1942.

The results of a five years' study on 20 sporophores of *Fomes igniarius* of known age from aspen at the Charles Lathrop Pack Demonstration Forest, Warrensburg, New York, indicated that one tube layer is normally formed in the hymenophore each year, departures from this rule being associated with restrictions of growth by surrounding callus or other adverse factors.

Rennerfelt (E.). **Chemical treatment of wet mechanical pulp in order to control damages caused by fungi.**—*Svenska SkogsvFören. Tidskr.*, xxxix, 1, pp. 19–94, 13 figs., 4 graphs, 1941. [Swedish summary.]

Most of the information presented in this comprehensive survey of the writer's laboratory experiments and practical observations on the control of the fungi responsible for the blue staining (e.g., *Pullularia pullulans*) and rotting (e.g., *Polystictus versicolor*) of wood pulp in Swedish factories has already been noticed from other sources [*R.A.M.*, xxi, p. 58], but the following points may be noted. None of the other preparations tested equalled lignasan and pulpasan (ethyl mercury chloride) in antiseptic value, the amounts of santobrite, dowicide, and tebecit (sodium orthophenylphenolate) required for the elimination of *Pullularia pullulans*, for instance, being 10, 40, and 100 times, respectively, as much as the appropriate dosage with pulpasan, i.e., 200 gm. per ton, the cost of which is estimated at Kr. 0·33 (at par). *Polystictus versicolor* is much more resistant to treatment than *Pullularia pullulans*, necessitating the application of 2·5 to 5 kg. of the fungicide per ton. Subjective measurements of whiteness (a criterion of freedom from fungal damage) are apt to give inconsistent results in cases of superficial infection, and should be repeated on suspended or re-filtered samples.

Rennerfelt (E.). **Die Empfindlichkeit einiger Phoma-Arten gegen Quecksilberverbindungen.** [The sensitivity of some *Phoma* species to mercury compounds.]—*Zbl. Bakt.*, Abt. 2, civ, 2–3, pp. 71–77, 1941.

At the Gothenburg (Sweden) Botanical Institute, the writer conducted experiments to determine the possibility of combating four organisms causing blue stain of wood pulp, viz., *Phoma conidiogena* [*R.A.M.*, xiii, p. 738], *P. lignicola* (strains a and b), and an unidentified species, *Phoma* A, by means of three mercury compounds, viz., mercuric chloride, pulpasan [see preceding abstract], consisting of 6 per cent. ethyl mercury chloride, soda, and sodium sulphate, and ethyl mercury chloride alone. The fungi were grown on malt agar and in saccharose-containing nutrient solutions with the admixture of various concentrations of the disinfectants. The two organic preparations were found to exert a much stronger fungicidal action than the inorganic, pulpasan being 5 to 20 and ethyl mercury chloride 80 to 320 times as effective as mercuric chloride; the requisite amounts of the three materials for the inhibition of germination of 1,000,000 spores of *P. conidiogena*, for instance, were 0·32, 0·02, and 1·6 mg. per flask, respectively, while *Phoma* A succumbed to only 0·005 mg. ethyl mercury chloride. *P. lignicola* was much more resistant to the action of mercury than the other species, 5 to 10 times the quantity of antiseptic being necessary for its elimination (up to 100 times in one test with mercuric chloride). These differences are probably attributable to variations in the internal structure of the conidial protoplasm, but the data at hand are insufficient to afford a convincing explanation of the phenomenon.

Hardy (E.). **Dry rot in the textile industry.**—*Text. Rec.*, lix, 709, p. 38, 1942.

Dry rot (*Merulius lacrymans* and other fungi) is stated to be exceptionally prevalent in the woodwork of textile factories, where the normal methods of controlling the fungus by a reduction in atmospheric humidity and temperature are not ordinarily practicable. Prevention must therefore be based primarily on the use of resistant woods, e.g., Rhodesian, Burma, Nigerian, or Borneo teak, tallow wood (*Eucalyptus microcorys*), deodar, juniper, Californian redwood [*Sequoia sempervirens*], southern cypress [*Taxodium distichum*], yew, larch, Australian jarrah [*E. marginata*], western red cedar [*Thuja plicata*], Port Orford cedar [*Chamaecyparis lawsoniana*], or yellow cedar [*Cupressus nootkatensis*]; and preservation with a reliable chemical antiseptic, such as solutions of arsenical salts, two coats of hot creosote (140° F.), 2 per cent. Wolman salts (triolith), 2 per cent. sodium fluoride, copper sulphate, or zinc chloride. Changes in the affected wood include loss of weight (which may reach 70 or 80 per cent.), deterioration in toughness, a damp, musty smell, increasing acidity, and liability to burning and insect attack.

White lead plus zinc chrome (2 per cent.) is the best paint for use in textile factories where moulds are prevalent. Zinc oxide is also a good preservative, and before repainting an antiseptic treatment with 1 in 100 sodium pentachlorphenate is recommended. Black fungal spotting on paint-work may be removed with soapy water containing carbolic acid and formalin, followed by 1 per cent. mercuric chloride.

Wilson (H. B.) & Gregory (J. N.). **A quantitative investigation of the steeping method for the preservation of timber. A modern application of an old process to Australian mine timbers.**—*J. Coun. sci. industr. Res. Aust.*, xiv, 4, pp. 281–287, 1941.

In an investigation carried out in Australia to find a suitable method for preserving round green mine timbers, pieces of freshly felled *Eucalyptus obliqua* carrying a piece of sapwood, about 6 in. square by 1 in. thick, were lacquered on all faces except the bark (which was removed only immediately before treatment) and subjected to one of the following treatments: one month, two weeks, or one week in either 5, 10, or 20 per cent. solutions of zinc chloride (fused) or copper sulphate crystals, the concentrations

being based on the weight of the anhydrous salts. After treatment, each sample was removed and allowed to dry in the air, after which the timber was analysed for the presence of the salts. From a practical point of view, the amount of chemical absorbed and the penetration obtained were very satisfactory. In the specimens treated in 5 per cent. solutions for one week, the concentrations of dry chemical half an inch from the surface were approximately 0·4 per cent. This is equivalent to 0·1 to 0·2 lb. of dry salt per cubic foot of treated wood. Concentration increased rapidly towards the outer surface.

It is concluded that treatment of the sapwood of *E. obliqua* by immersion in cold aqueous solutions of zinc chloride or copper sulphate gives penetrations and absorptions of the order required for preserving the wood under service conditions in mines. A very high concentration, amounting probably to several lbs. of chemical per cu. ft. of treated wood, is quickly built up in the outer layers of the sapwood (up to $\frac{1}{8}$ in. in depth). For timbers intended for a short service life (5 years) an immersion for one week in a cold 5 per cent. solution of zinc chloride or copper sulphate would probably suffice. If longer service life is required, longer immersion periods and more concentrated solutions can be used. Treatment must be effected when the timber is freshly cut, before surface drying has occurred.

Green (D. E.). **Hygiene in the war-time vegetable garden. XI. XII. XIII. XIV.**—*J. R. hort. Soc.*, lxvii, 1, pp. 33–39, 2 pl. (between pp. ii and iii); 2, pp. 62–68, 2 pl. (between pp. xii and xiii); 3, pp. 97–102, 2 pl. (between pp. 90 and 91); 4, pp. 136 and 142, 2 pl. (between pp. xxvi and xxvii), 1942.

These further instalments of the author's series of instructions on the care of British war-time allotments [*R.A.M.*, xxi, p. 112] comprise observations on the diseases of beets, maize (sweet corn), seakale, Jerusalem artichokes [*Helianthus tuberosus*], asparagus, rhubarb, horse-radish, mushrooms, mint and other herbs, cress, and watercress.

Ramsey (G. B.) & Wiant (J. S.). **Market diseases of fruits and vegetables : Asparagus, Onions, Beans, Peas, Carrots, Celery, and related vegetables.**—*Misc. Publ. U.S. Dep. Agric.* 440, 70 pp., 16 pl. (8 col.), 1941.

This publication is the seventh in a series designed to assist in the recognition and identification of pathological conditions of economic importance affecting fruits and vegetables in storage and transit and on the market, to facilitate the inspection of these products when exposed for sale, and to prevent the losses arising from such causes. It is an amplified and revised version, including some excellent new coloured illustrations, of the 'Handbook of diseases of vegetables occurring under market, storage, and transit conditions', prepared by G. K. K. Link and M. W. Gardner and published by the United States Department of Agriculture in 1919. Reference to most of the diseases described under the various crops has been made from time to time in this *Review*. An 11-page bibliography is appended.

Coke (J. E.). **Disease and bolting resistance in varieties.**—*Sug. Beet Bull.*, vi, 1, p. 5, 1942.

In a series of varietal tests on sugar beets conducted by the Spreckels Sugar Company in California from 1939 to 1941, the incidence of curly top in the newly developed strains, U.S. 15, U.S. 33, U.S. 22, and U.S. 23 [*R.A.M.*, xxi, p. 114] was as follows: December, 1939 (two first-named only) 7 and 2 per cent., respectively; March 1940 (two locations), 55, 26, 12, and 12, and 97, 50, 13, and 15 per cent., respectively; and February, 1941, 6·11, 1·67, 0, and 0·33 per cent., respectively, the figures for the Old Type on the corresponding dates being 8, 59, 89, and 4·44 per cent., respectively. It is apparent from these data that U.S. 22 excels all the other strains in commercial use from the standpoint of curly top resistance, closely followed by 23, while 33 withstands the disease adequately, at any rate in the mild and localized form

in which it has occurred of recent years. U.S. 22 and 23 are particularly well adapted for late, and 33 and 12 (intermediate between 22 and 33 for resistance to curly top) for mid-season planting. None of the new strains equalled U.S. 15 and Old Type in respect of resistance to mildew [*Peronospora schachtii*: ibid., xix, p. 131].

WALKER (J. C.). **Physiologic races of Plasmodiophora brassicae.**—Abs. in *Phytopathology*, xxxii, 1, p. 18, 1942.

Several turnip and swede varieties, tested with various collections of *Plasmodiophora brassicae* from widely separated localities in the United States, remained completely free from club root in heavily infested soil. One of these, Purple Top Milan turnip, grown in naturally infested soil in two districts in England (by F. T. Bennett in the north and by N. C. Preston in Shropshire), developed some 20 per cent. infection in each case. On the other hand, an English variety, White Stone, which produced 87 per cent. diseased plants in a trial in England, developed no clubbed roots on inoculation with a representative American isolate. These data are regarded as establishing the existence of physiologic specialization in *P. brassicae* [*R.A.M.*, xii, p. 608].

DENNIS (A. C.). **Boron deficiency in members of the Cabbage family.**—*Fertil. Feed. St. J.*, xxvii, 4, pp. 41, 43; 6, pp. 55, 57, 3 figs., 1942.

The available information concerning boron deficiency in crucifers [*R.A.M.*, xxi, pp. 60, 113] is summarized and the symptoms of the trouble described in relation to particular crops. Directions are also given for the control of the disorders due to lack of boron by the introduction of the element into the soil in the form of borax or boric acid, preferably in amounts not exceeding 20 lb. per acre for the former and 13 lb. for the latter.

BRENCHLEY (W[INIFRED] E.) & WARINGTON (K.). **Value of molybdenum for Lettuce.**—*Nature, Lond.*, cxlix, 3772, p. 196, 1942.

In work on the minor element constituents of Chilean nitrate it was found that one part of molybdenum [cf. *R.A.M.*, xx, pp. 56, 479] (as sodium molybdate) in 10,000,000 of nutrient solution improved the size, colour, and disease resistance of lettuces. This improvement occurred whether the molybdenum was used alone or in conjunction with one or more other minor elements. Preliminary tests gave some indication that molybdenum can retard the appearance of boron deficiency symptoms in the early stages of growth.

JENKINS (J. M.). **Downy mildew resistance in Cucumbers.**—*J. Hered.*, xxxiii, 2, pp. 35–38, 2 figs., 1942.

Out of over 80 varieties and strains of cucumber tested in 1939 at the South Carolina Agricultural Experiment Station for their reaction to downy mildew (*Peronospora* [*Pseudoperonospora*] *cubensis*), only China and Puerto Rico No. 37 [*R.A.M.*, xx, p. 564] gave evidence of a high degree of resistance, with indices of 3 and 1, respectively (classified on a scale from 0, representing immunity, to 10, denoting complete susceptibility). Neither of these varieties, however, satisfied market requirements, and each was accordingly crossed with Colorado, a good commercial variety, in order to combine the desirable characteristics of the latter with the resistance to mildew of No. 37 and China. The F_1 plants were intermediate both as regards resistance and the size and shape of the fruits. In the F_2, 17 plants were equally resistant with the resistant parent, 26 as susceptible as Colorado, and 545 intermediate—the last-named group, however, comprising individuals only slightly less susceptible than the commercial parent and others almost equalling the resistant progenitor in resistance. Genetic studies on the inheritance of resistance to *P. cubensis* are being continued in the F_3.

In a comparative test in 1941 on the A. & C., Colorado, China, and No. 37 varieties, the last-named was again the least affected by the pathogen.

DEMAREE (J. B.) & RUNNER (G. A.). **Control of Grape diseases and insects in eastern United States.**—*Fmrs' Bull. U.S. Dep. Agric.* 1893, 28 pp., 21 figs., 1942.

Brief, practical notes are given on the symptoms, causes, and control of the principal vine diseases found in regions of the United States east of the Rocky Mountains. Those mainly attacking American bunch grape varieties include black rot (*Guignardia bidwellii*), downy mildew (*Plasmopara viticola*), anthracnose (*Elsinoe ampelina*), ripe rot (*Glomerella cingulata*), bitter rot (*Melanconium fuligineum*) [*R.A.M.*, xvii, p. 726], dead arm (*Cryptosporella viticola*) [ibid., xvii, p. 499], powdery mildew (*Uncinula necator*), and root diseases due to crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) [cf. ibid., xvii, p. 727] and the cotton root rot fungus (*Phymatotrichum omnivorum*) [ibid., x, p. 241]. The diseases of muscadine grapes [cf. ibid., xx, p. 623; xxi, p. 239] dealt with include black rot (which does not cause decay of the fruits, but produces fruit scab and foliar spotting), bitter rot, and two fungi which attack old foliage, viz., a species of *Cercospora* [loc. cit.] and *Isariopsis clavispora* [ibid., xvii, p. 843].

The authors point out that downy mildew, being favoured by cool, moist weather, is of minor importance in the southern regions of the United States. The disease is comparatively easy to control, and seldom produces damage in vineyards sprayed regularly against black rot.

The general spray programme recommended (though modifications are, naturally, required to adapt it to the requirements of different localities) is as follows: (1) spray with Bordeaux mixture (4–4–50) when the new shoots are 7 to 8 in. long; (2) the same plus 1 lb. calcium arsenate or lead arsenate and ½ pint fish oil or linseed oil per 50 gals. spray one week before blooming; (3) repeat (2) just after the blossoms fall; (4) two weeks after (3) spray with Bordeaux mixture (4–4–50) plus ⅜ pint of nicotine sulphate (40 per cent. nicotine) and 1 lb. resin-fish oil soap (or ½ pint fish oil or linseed oil) in 50 gals. of spray; and (5) two or three weeks later, or when the fruit is about half-grown make a final application of Bordeaux mixture (4–4–50). In regions where black rot is serious preliminary application of Bordeaux mixture (4–4–50) must be given when the shoots are only 1 to 2 in. long. Emphasis is laid on the fact that the early sprays are the most important ones.

Because of the long growing season and frequent rains in Florida and other South Atlantic and Gulf States, the spray schedule which suffices to control vine diseases in the area north of the Ohio River and east to the Atlantic coast is inadequate in the former region, where twice as many sprays may be required as in Michigan; growers residing south of Virginia, Tennessee, and Missouri should seek official advice on the timing and number of applications.

NICHOLSON (A. J.), DICKSON (B. T.), HYNES (H. J.), & EVANS (J. W.). **Plant quarantine. Report of the Central Committee appointed by the Australian Institute of Agricultural Science to deal with Overseas Plant Quarantine.**—*J. Aust. Inst. agric. Sci.*, vii, 4, pp. 143–146, 1941.

This report of the central committee appointed by the Australian Institute of Agricultural Science to examine the Australian system of overseas plant quarantine states that the members agreed in the first place that plant quarantines must be based on sound biological principles and that the objectives aimed at must be such that there is a reasonable possibility, from a biological standpoint, of attaining them. They must be economically justifiable, not unnecessarily restrictive, and never used for any purpose but the exclusion of pests and diseases, while their administration must remain independent of outside interests. The requirements of an efficient plant quarantine service are: a well-trained staff, appropriate regulations, and satisfactory equipment and facilities.

Recommendations are made on these aspects. There should be three specialist assistants with the Director of Plant Quarantine, acting as a central staff, which should study plant diseases and pests, and collate the information obtainable as to their economic importance, life-history, host range, world distribution, and the likelihood of their introduction into Australia. The Central Quarantine Office should act as an information bureau, to which all information concerning the introduction and subsequent spread or disappearance of all introduced pests, diseases, and weeds should be sent. This information would then be passed on to all the States concerned, and would be followed periodically by progress reports. A full-time, well-trained Commonwealth Quarantine Officer should be employed in each State. The part-time employment of State officers in Commonwealth inspection duties should be continued. The appointment of an Advisory Plant Quarantine Board, such as exists in Canada and South Africa, is not recommended, but an advisory committee in each State would serve a useful purpose. It is also desirable that a National Advisory Committee, comprising one representative from each State committee, should be formed to assist the Director of Plant Quarantine on occasion.

Recommendations for suitable regulations indicate types of regulation covering all contingencies. Equipment is too costly to be provided at all ports of entry. Hence, plants and plant products in certain categories should be allowed entry only at ports where special facilities are available. An inspector should be stationed at each port of entry of overseas goods.

The present position is that there is a Director of Plant Quarantine appointed by the Commonwealth Government in 1927, who is responsible to the Permanent Head of the Department of Health. No other full-time officer has been appointed to the Commonwealth service for plant quarantine. All other officers are appointed at the request and on the recommendation of the State Departments of Agriculture, and from the services of these Departments, being State officers seconded for Commonwealth service. Some 75 quarantine officers are at present engaged in inspection duties for the Commonwealth; of these, seven are wholly occupied in foreign plant quarantine work.

The report concludes by pointing out that in comparison with the sums spent on the attempted control of diseases, weeds, and pests, already introduced, the amount at present devoted to the exclusion of others is nugatory. The further sums required to ensure the efficiency of the plant quarantine service should be looked upon as an insurance, as the increased expenditure would, actually, represent a real economy in the national interest.

FERRAZ DO AMARAL (J.). **Videiras de facil cultura.** [Easily cultivable Vines.]—*Biológico*, viii, 1, pp. 15–19, 2 figs., 1942.

The Seibel No. 2 hybrid, locally known as Corbina, is stated to be virtually the only vine grown on a commercial scale in São Paulo, where it gives satisfactory yields and is sufficiently resistant to anthracnose [*Elsinoe ampelina*: *R.A.M.*, xix, p. 366] and *Peronospora* [*Plasmopara viticola*] provided the normal cultural methods are supplemented by three summer applications of Bordeaux mixture and one winter treatment with lime-sulphur. Of the various other Seibel hybrids grown experimentally, only No. 6,905 proved extremely susceptible to *E. ampelina*, to which, as well as to *P. viticola*, Nos. 7,053, 10,096, 8,712, 6,486, 4,986, and 5,213 were equally resistant with No. 2.

DONEN (I.). **Mould control in Grapes. Results obtained with the use of sulphur dioxide.**—*Fmg S. Afr.*, xvii, 192, pp. 199–208, 3 graphs, 1942.

In experiments carried out in Cape Town on the control of mould [unspecified] in table grapes [*R.A.M.*, xx, p. 50], Waltham and Barlinka grapes were treated by exposure before packing to 2 per cent. sulphur dioxide gas for 30 minutes at 68° F.,

by similar exposure after packing, by placing a 0·25 gm. tablet of sodium acid sulphite with each bunch, and by both gassing and tablet treatment before packing. Gassing was effected in the packhouse, where the fruit was left for seven days, after which it was examined. In the Barlinka grapes, the untreated controls showed 169 mouldy berries per five boxes, with 44 per cent. green stalk, while the corresponding figures for the different treatments were, gas before packing 72 and 96 per cent., tablets 49 and 55 per cent., gas and tablets 0 and 100 per cent., and gas after packing 8 and 90 per cent. In the Waltham Cross grapes, the corresponding figures were 126 and 0 per cent., 56 and 70 per cent., 60 and 36 per cent., 23 and 87 per cent., and 22 and 80 per cent. The best results were found in the fruit gassed after packing. Gas treatment conspicuously affected the appearance of the stems, which remained fresh and yellow-green, in contrast to the controls, which were brown and dry. Fruit given gas and tablets showed some bleaching of the stalk and slight discoloration of a few berries.

In a further test, two lots of Barlinka grapes were exposed to 2 per cent. sulphur dioxide for 35 minutes after packing. After seven days, the first lot showed 25 mouldy berries and 82 per cent. green stalk, and the second lot 116 mouldy berries and 66 per cent. green stalk, as against 227 mouldy berries and 19 per cent. green stalk in one control lot and 252 mouldy berries and 61 per cent. green stalk in the other control. The gas treatment is considered to have lengthened the commercial life of the fruit by eight days. Apparently, the sulphur dioxide only served to retard the onset of mould attack, since the graphs for the amount of mould in the treated grapes and controls met after 19 days. Even after 21 days' storage at 32° the beneficial effect of the gas was noticeable.

On several occasions gas-treated grapes fetched higher prices than untreated controls in commercial markets. The treatment caused no injury of any commercial importance.

It is considered that this gas treatment offers a very promising method of increasing the selling life of non-refrigerated grapes sent to African markets. The method is very suitable for mass treatment in which concentration and time can be controlled, and can be applied to fruit in any container. The cost of gas and extra handling should be under one halfpenny per box of fruit. The cost of constructing a special chamber for the treatment measuring 3 ft. 6 in. by 3 ft. 4 in. by 6 ft. amounts to about £10 locally, and there is also the fan to be purchased. This outlay, however, when reckoned over a period of years, is negligible.

Legislative and administrative measures.—*Int. Bull. Pl. Prot.*, xv, 11, pp. 206M–207M, 1941.

GERMANY (Protectorate of Bohemia and Moravia). Notification No. 463 of 24th February, 1941, promulgated by the Minister of Agriculture, defines the localities to be regarded as 'prohibited zones' owing to the actual or suspected presence of potato wart disease (*Synchytrium endobioticum*) [*R.A.M.*, xix, p. 320] therein or in the immediate vicinity. The export of potatoes or potato trash from prohibited to non-prohibited areas, and the introduction into, and cultivation within, the prohibited zones of wart-susceptible varieties are interdicted.

Decree No. 227 of 6th March, 1941, amending No. 133 of 22nd February, 1940, provides for the disinfection with a formaldehyde solution of railway trucks which have been used for the transport of potatoes cultivated in a prohibited zone.

As from 1st March, 1945, the cultivation of potatoes other than those resistant to *S. endobioticum* will be disallowed.

GERMANY (Saxony). The Decree of 22nd May, 1940, relative to the control of asparagus rust (*Puccinia asparagi*) [cf. ibid., xv, p. 192], was suspended for the duration of the year 1941 owing to war conditions.